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EDITED BY

P. M. D. SANDERSON, F.Z.S., S. H. PRATER, C.M.Z.S., M.L.C., J.P.
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459	15 from top	Rainey	Stoney
553	9 ,,	Tennasserim	Tenasserim
553	26 from bottom	Hsaipaw	Hsipaw
553	23 ,,	Shah	Shan
556	15 ,,	hides	skins
557	28 ,,	remvoed	removed
623	5 from top	Dates	Oates
633	2 from bottom	Sumpralum	Sumprabum
638	last line	*harringtoni*	*zonorhyncha*
648	13 and 14 from top	Yunan	Yunnan

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CORRIGENDA

Page	*Line*	*For*	*Read*
774	29	**reinwardtii**	**Reinwardtii**
,,	8 from bottom	**leana**	**Leana**
775	7 ,,	**Exodictyoa blumii**	**Exodictyon Blumii**
,,	14 ,,	**bowringii**	**Bowringii**
776	20	**hampei**	**Hampei**
777	12 from bottom	**rigbyanum**	**Rigbyanum**
778	11	**Maromitrium turgidum**	**Macromitrium turgidum**
,,	27	**wallichii**	**Wallichii**
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,,	13 from bottom	**thomsoni**	**Thomsoni**
780	10	**halleriana**	**Halleriana**
,,	13	**gammieana**	**Gammieana**
781	14 from bottom	**borii**	**Borii**
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785	13 ,,	**montagueanum**	**Montagueanum**
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792	8	**Giammella**	**Gammiella**
,,	19	**ambylostega**	**amblyostega**
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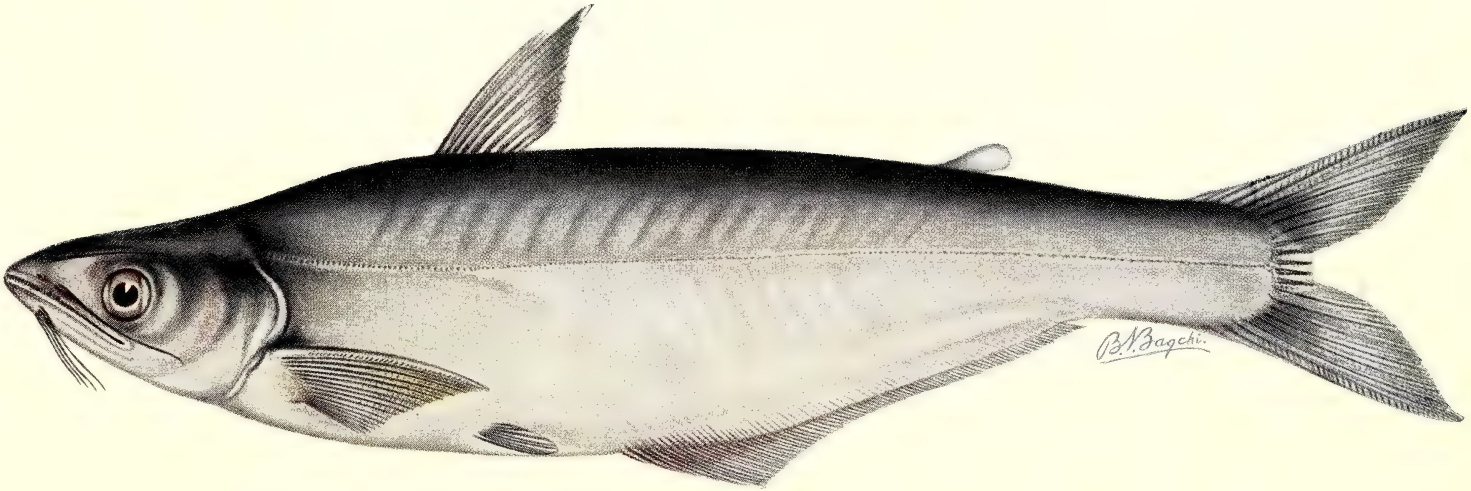

THE BACHHWA OR BUTCHWA.
Eutropiichthys vacha (Hamilton).

JOURNAL

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Bombay Natural History Society.

SEPTEMBER 1937. VOL. XXXIX. NO. 3.

THE GAME FISHES OF INDIA[1]

BY

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Assistant Superintendent, Zoological Survey of India, Calcutta.

(*With one plate and eight text-figures*).

Continued from page 210 *of* Vol. xxxix.

II.—'THE BACHHWA OR BUTCHWA'.[2]

EUTROPIICHTHYS VACHA (HAMILTON).

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INTRODUCTION.

There are two types of Catfishes which are termed *Butchwa* among anglers. In Bengal, where both species are found in abundance, the name *Bāchchā* is invariably applied to *Eutropiichthys vacha* (Ham.), an elegant fish with a large mouth, as in the 'Indian Trout' (**15**).[3] The other species, known as *Garua* or *Garua*

---

[1] Published with permission of the Director, Zoological Survey of India.

[2] Also known as *Batchwa, Batchúa, Váchá* and *Báchchá*.

[3] Numerals in thick type within brackets refer to the serial numbers of the various publications listed in the bibliography at the end of the paper.

OCT 27 1937

Bāchchā, has a much smaller mouth and, though belonging to the same family *Schilbeidae,* is included in a separate genus, *Clupisoma* Swainson. It may be noted that in all books on angling in India the accounts of these two types of *Butchwa* are greatly confused. It is proposed, therefore, to give a description of the true *Bāchchā* in this article, and to reserve the treatment of *Clupisoma garua* (Hamilton) for the next.

TAXONOMY.

Nomenclature and Systematic Position.

The species was originally described by Hamilton (**13**) as *Pimelodus vacha* and was included by him among a heterogeneous assemblage of Catfishes. Swainson (**21**) assigned it to the genus *Pachypterus* and named it *P. punctatus,* while Cuvier and Valenciennes (**4**) considered it to be a *Bagrus.* Bleeker (**2**) also regarded it as a *Bagrus* in the first instance, but later he (**3**) defined its precise limits and proposed for its reception a new genus *Eutropiichthys* in his group Pangasii. The genus was defined as:

> 'Cirri 8, nasales 2, supramaxillares 2, inframaxillares 4. Dentes maxillis pluriseriati. Dentes vomerini vel palatini nulli. Oculi superi. Rictus sub oculo productus.'

This diagnosis appears to have been based on Hamilton's original description and figure, for it is stated therein 'In both are crowded numerous sharp *teeth,* of which there are none on the palate.' Günther (**11**), without examining any specimen of Hamilton's species, accepted Bleeker's genus; but Day (**5**) pointed out that in *E. vacha* there are

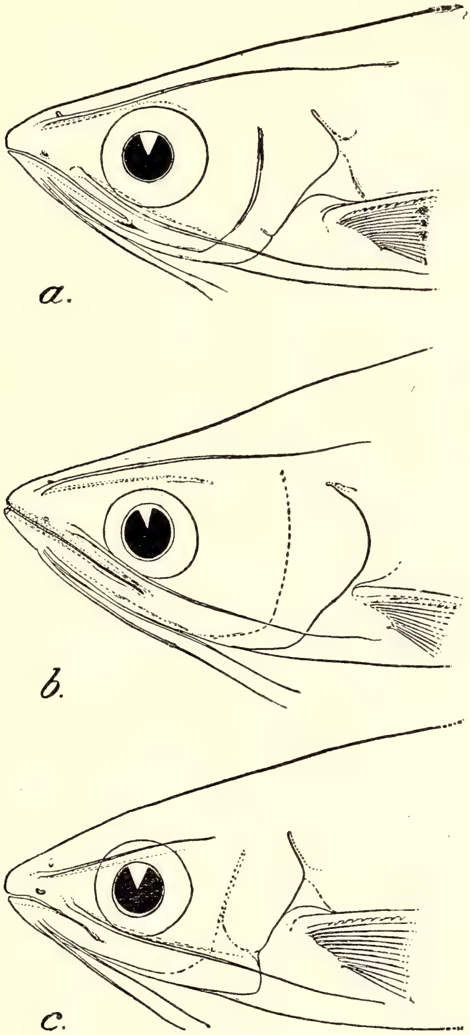
> 'villiform teeth in a triangular spot on the vomer, and in a large pyriform shape on the palate; the whole of these with those on the upper jaw are so closely set together that it may give the appearance on a superficial examination that there are "no teeth on the palate" as remarked by Dr. Günther.'

Day (**6**) was also the first to describe the air-bladder of *E. vacha* as

> 'narrow, tubiform, placed transversely across the body of the anterior vertebrae, and all but its central portion enclosed in bone, either expanded extremity being within a bony capsule.'

Though in the original definition of *Eutropiichthys* no mention is made of the teeth on the palate and of the nature of the air-bladder, these form the chief diagnostic features of the genus which may be defined as follows:

The body is elongate and compressed. The head is covered with soft skin. The snout is pointed; usually it is sharp but in some specimens it is slightly blunt. There is a narrow median fontanel on the head, commencing slightly behind the posterior nostrils and extending almost to the termination of the occipital process. *The mouth is wide and ascending;* it reaches below the orbit or may slightly extend beyond the posterior margin of the orbit. The upper jaw is slightly longer. The nostrils are wide apart. The eyes are lateral and are provided with broad adipose lids.

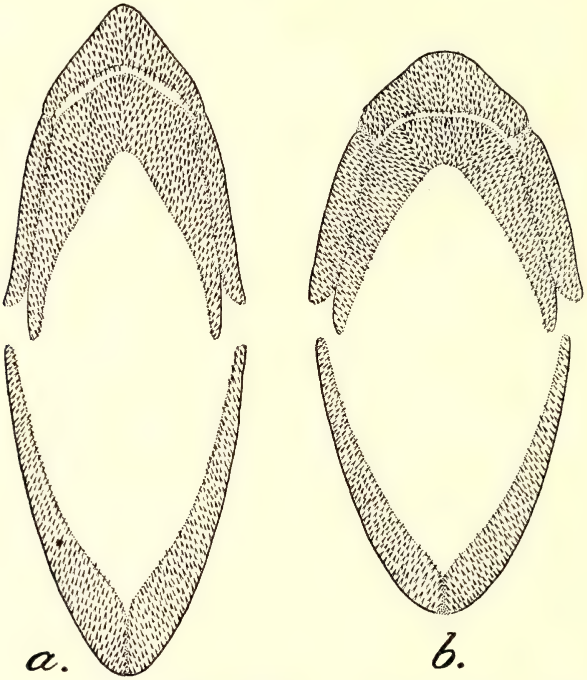


Text-fig. 1. Lateral view of head and anterior part of body of the three species of *Eutropiichthys* Bleeker.

a. E. goongwaree (Sykes), $\times 1\frac{2}{3}$; *b. E. vacha* (Ham.) $\times 1\frac{1}{3}$; *c. E. murius* (Ham). $\times 1\frac{2}{3}$.

There are eight barbels, one pair nasal, one pair maxillary and two pairs mandibular.

The jaws are provided with several rows of sharp, villiform teeth; the toothbands are produced backwards at the sides. *The* *teeth* (fig. 2) on the palate form a continuous vomero-palatine band which is also produced at the sides. The band is sometimes interrupted in the middle and sometimes it is so close to the maxillary band that the two appear to be contiguous. The rayed dorsal fin is short, with one spine and seven rays. The adipose dorsal is also short and is situated far behind. The pectoral fin is provided with a spine, while the pelvic fin has only six rays. The anal fin is long, but is separated from the caudal by a considerable distance; it has usually 47-50 rays. The caudal fin is deeply forked.

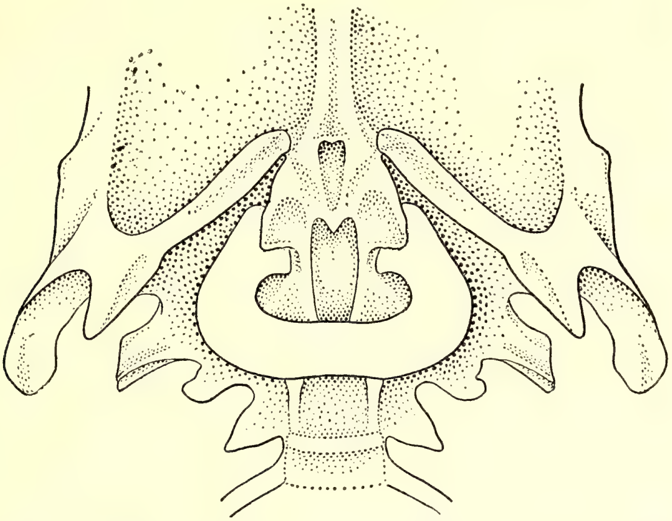


Text-fig. 2. Dentition of two specimens of *Eutropiichthys vacha* (Ham.).
a. Long-snouted specimen from Chittagong, 251 mm. in length without caudal. ×1½; *b.* Blunt-snouted specimen, probably from Burma (*A.S.B. Cat.* No. 484), 192 mm. in length without caudal. ×2.

The gill-openings are wide; the gill-membranes being separated by a deep notch and not confluent with the skin of the isthmus. The branchiostegal rays vary from 5 to 11.

The air-bladder (fig. 3) is greatly reduced, tubular and transverse; it lies closely applied to the ventral surface of the anterior vertebrae and forms a circular loop incomplete anteriorly; it is not enclosed by bone but is supported on the dorsal surface by the bony extensions of the transverse processes of the anterior vertebrae.

The characters italicised above are the most important diagnostic features of the genus, and have afforded me a clue to refer two more species—*Pimelodus murius* Hamilton (**13**, p. 195) and *Hypophthalmus goongwaree* Sykes (**22**, p. 369) to the genus



Text-fig. 3. Air-bladder and associated skeletal parts in *Eutropiichthys vacha* (Ham.). Length of specimen 152 mm. without the caudal. ×5

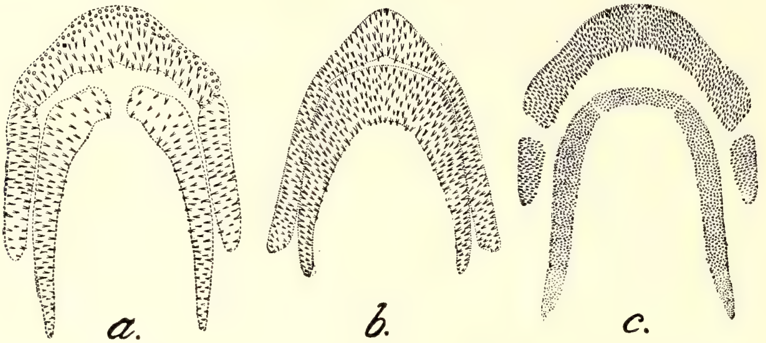
Eutropiichthys. The three species may be distinguished by the following key :

A. Vomero-palatine band interrupted in middle (fig. 4, *a*) ; cleft of mouth extending to below first third of eye ; nasal barbel extending to base of dorsal ; eye $2\frac{3}{4}$ in length of head (fig. 1, *a*). *E. goongwaree* (Sykes).

B. Vomero-palatine band complete in middle.
  a. Vomero-palatine band wider than maxillary band (fig. 4, *b*) ; branchiostegals 11 ; cleft of mouth nearly extending to hind border of orbit ; nasal barbel rarely extending to hind border of head or slightly beyond ; eye $3\text{-}4\frac{1}{2}$ in length of head (fig. 1, *b*) ... *E. vacha* (Ham.).

  b. Vomero-palatine band narrower than or just as wide as maxillary band (fig. 4, *c*) ; branchiostegals 5 ; cleft of mouth extending to front edge of eye ; nasal barbel extending to short distance behind posterior edge of eye ; eye $3\text{-}3\frac{3}{4}$ in length of head (fig. 1, *c*) *E. murius* (Ham.).

Both *E. goongwaree* and *E. murius* were referred to the genus *Pseudeutropius* Bleeker by Günther (**11**) and Day (**8**, **9**); though their authors had indicated their close similarity to Hamilton's *Pimelodus vacha*. It is outside the scope of this work to discuss in detail the relationships of the three species. It may, however, be indicated that from the point of view of an angler their specific characteristics should make very little difference. *E. goongwaree* is found in the rivers of the Deccan, and was originally described from the Mota Mola river near Poona. *E. murius* is known from the 'Rivers of Sind, Orissa, the Jumna and rivers of Bengal and Assam'. *E. vacha* is still more widely distributed and besides northern India it is found in Burma and Siam.



Text-fig. 4. Upper dentition of the three species of *Eutropiichthys* Bleeker. *a. E. goongwaree* (Sykes). $\times 3\frac{2}{3}$; *b. E. vacha* (Ham.). $\times 1\frac{1}{3}$; *c. E. murius* (Ham.). $\times 5\frac{1}{3}$.

The genus *Eutropiichthys* is included in the family Schilbeidae (**19**), of which Pangasiidae may be regarded as a synonym. This family occurs in Indo-China, Siam, the Malay Peninsula and the Archipelago, Burma, India and the tropical parts of Africa.

The Schilbeidae are a family of the Sub-order Siluroidea of the Order Ostariophysi. They are popularly known as Catfishes, on account of their long barbels.

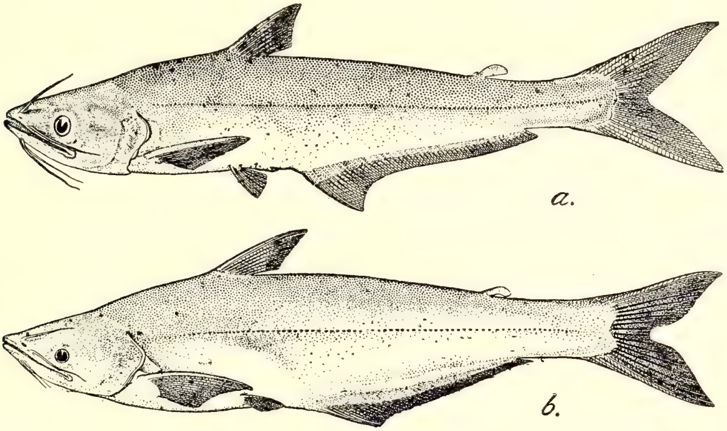
Synonymy and Description.

Eutropiichthys vacha (Hamilton).

1822. *Pimelodus vacha,* Hamilton, *Fish. Ganges,* pp. 196, 378; pl. xix, fig. 64.
1839. *Pachypterus punctatus*, Swainson, *Nat. Hist. Fish.* etc., ii, p. 306.
1839. *Bagrus vacha,* Cuvier and Valenciennes, *Hist. Nat. Poiss.,* xiv, p. 392.
1854. *Bagrus vacha,* Bleeker, *Verh. Bat. Gen.,* xxv, pp. 56, 112.
1862. *Eutropiichthys vacha,* Bleeker, *Versl. Akad. Amsterdam,* xiv, p. 398.
1863. *Eutropiichthys vacha,* Bleeker, *Ned. Tijdschr. Dierk.,* i, p. 107.
1864. *Eutropiichthys vacha,* Günther, *Cat. Fish. Brit. Mus.,* v, p. 38.
1869. *Eutropiichthys vacha,* Day, *Proc. Zool. Soc. London,* p. 306 (*dentition*).
1869. *Eutropiichthys vacha, Günther, Zool. Rec.,* p. 134 (*dentition*).
1871. *Eutropiichthys vacha,* Day, *Proc. Zool. Soc. London,* p. 713 (*air-bladder*).
1873. *Eutropiichthys vacha,* Day, *Rep. Freshw. Fish. Fisheries, India and Burma,* p. 270.
1877. *Eutropiichthys Burmanicus,* Day, ibid., p. 490.
1877. *Eutropiichthys vacha,* Day, *Fish. India,* p. 490, pl. civ, fig. 6.
1877. *Eutropiichthys vacha,* Beavan, *Freshw. Fish. India,* p. 131.
1880. *Pseudeutropius goongaree,* Vinciguerra (*nec* Sykes), *Ann. Mus. Civ. Stor. Nat. Genova,* xviii, p. 91.
1889. *Eutropiichthys vacha, Faun. Brit. Ind. Fish.,* i, p. 128, fig. 55.
1889. *Eutropiichthys burmanicus,* Day, *Faun. Brit. Ind. Fish.,* i, p. 128.
1890. *Eutropiichthys vacha,* Vinciguerra, *Ann. Mus., Civ. Stor. Nat. Genova* (2), ix, p. 71.

1894. *Eutropiichthys vacha*, Bridge and Haddon, *Phil. Trans. Roy. Soc. London* (B), clxxxiv, p. 201 (*air-bladder and skeleton*).
1929. *Eutropiichthys vacha*, Prashad and Mukerji, *Rec. Ind. Mus.*, xxxi, p. 175, figs. 2 and 3.

Vernacular names.—Vacha (Dinajpur, Goalpara, Calcutta); *Tunti, Kangon* and *Caingun* (Lakshmipur); *Katla* (Purniah); *Bachoya* (Bhagalpur); *Sugwa-bachoya* (Patna); *Butchua* and *Nandi butchua* (Orissa); *Chel-lee* (Sind); *Neemuch* (N. W. Sub-Himalaya); *Nga-myen-kouban, Katha-boung* and *Nga-myee ying* (Burma); *Nga-glaung* (Myitkyina District, Upper Burma).



Text-fig. 5. Lateral view of a Siamese and a Calcutta specimen of *Eutropiichthys vacha* (Ham.) of about the same length. $\times \frac{3}{10}$.
a. Siamese example; *b.* Calcutta example.

B. 11; D. 1/7 | 0; A. 3-4/41-52; P. 1/13-16; V. 6; C. 17.

The length of head is contained from $5\frac{1}{2}$ to $5\frac{3}{4}$ times in the total length and $4\frac{1}{5}$ to 5 times in the length without the caudal. The height of the body is very variable in specimens from different localities; in a specimen from Siam the body is very narrow, but it gradually becomes deeper in specimens from Burma, Chittagong, Calcutta and the Panjab. The depth of the body is contained from $4\frac{1}{6}$ to 5 times in the total length without the caudal. The snout is invariably pointed, but in very rare cases it is slightly rounded. There is a single, narrow and long fontanel on the head. The occipital process is long and pointed; it is nearly 3 times as long as wide. The eye is large, lateral in position and is situated above the cleft of the mouth; it is provided with broad adipose lids. The diameter of eye is contained from 3 to $4\frac{1}{2}$ times in the length of the head; 1 to $1\frac{1}{2}$ times in the length of the snout and $1\frac{1}{10}$ to 1 in the interorbital distance. The gape of the mouth extends to below the posterior margin of the orbit, and is equal to half the length of the head. The upper jaw is slightly longer. There are eight barbels of varying lengths; as a rule, they are longer in young specimens than in adults. In Burmese and Siamese specimens the barbels are relatively longer. As a rule, none of the barbels is longer than the head, but in young specimens and in some Burmese examples they are considerably longer. The two pairs of mandibular barbels are situated almost in a row. The teeth are sharp and villiform; those on the jaws form broad bands which are produced backwards at the sides. The vomero-palatine band is considerably broader than the maxillary band and is pyriform in shape; this band is sometimes so close to the maxillary band that the two are indistinguishable from each other.

In Indian specimens the dorsal fin commences slightly in advance of the ventrals, while in Burmese and Siamese examples it is either opposite or slightly behind the origin of the ventrals. The dorsal spine is weak and faintly serrated along its posterior edge; it is almost as long as the head, excluding the snout. The pectoral fins extend beyond the origin of the ventrals; the pectoral spine is roughened externally and serrated internally; the rugosity of the outer surface is more pronounced in Burmese specimens. This spine is as long as the dorsal spine or slightly longer. The anal fin is considerably higher anteriorly than towards its posterior end. The caudal fin is deeply forked with both the lobes pointed.

The body is silvery with the back greyish—a neutral tint of cobalt blue. There are patches of vermilion of different shades on the jaws, upper and lower margin of the orbit, gill-cover, base and rays of the pectoral fin and along the ventral edge of the body. The anal fin has a light neutral tint, while the caudal has a much deeper neutral tint with the dorsal and the ventral edges light. The anterior half of the dorsal fin and the whole of the adipose dorsal are of the same colour as that of the back.

Measurements, Distribution and Variation.

Day (**8**) gives the distribution of *Eutropiichthys vacha* as 'From the Punjab through the large rivers of Sind, Bengal, Orissa, and variety *E. Burmanicus* in Burma'. Quite recently Suvatti (**20**) extended its range to Siam. The Mahanadi river in India probably forms its southernmost limit as it has not so far been recorded from the Deccan.

The Burmese specimens were separated by Day into a distinct variety *burmanicus* which he characterised as follows:

> 'Variety *Eutropiichthys Burmanicus* has A. 4/55, and its nasal barbels almost reach to the dorsal fin; the maxillary to the middle of the pectoral spine, whilst all the others are longer than the head. The pectoral spine is serrated externally, and reaches the anal fin.'

Day does not mention the precise locality in Burma from where he obtained his specimen or specimens of *E. burmanicus*. Vinciguerra (**24**), who examined several examples of *E. vacha* from Mandalay, Bhamo and Bassein did not find any examples of Day's variety. Similarly, Prashad and Mukerji (**18**) who studied Burmese material did not come across this variety. In the collection of the Indian Museum there is a specimen from Burma (Dup. Cat., No. 39) purchased from Day, which has longer barbels (fig. 1, *b*) and the anal fin, but does not quite show the characters of *E. burmanicus*. There are two other specimens fom Mandalay (Dupt. Cat., Nos. 161, 246) which have long barbels, but in them the snout is somewhat blunt. In view of the above the precise

Measurements[1] in millimetres

	BURMA		CHITTAGONG				HOOGLI RIVER, BENGAL				
	Mandalay.	A.S.B. Cat. 486					Calcutta	Pulta		Kanchrapara	
Total length without caudal ...	131·0	177·0	208·0	204·0	175·0	172·0	156·0	310·0	218·0	189·0	166·0
Length of head	24·0	35·0	41·5	41·0	36·0	35·0	33·0	70·0	48·0	42·0	37·0
Height of head	19·0	27·0	32·0	32·0	26·0	26·0	23·0	56·0	34·0	30·0	27·0
Width of head	11·3	20·0	26·0	26·0	23·0	21·0	18·5	45·0	28·0	25·0	22·0
Width of body	9·5	13·0	23·0	23·0	19·0	18·0	15·5	42·0	24·0	23·0	21·0
Height of body	29·0	39·0	47·0	47·0	41·0	40·0	33·0	75·0	48·0	45·0	40·0
Diameter of eye	8·0	11·0	10·0	10·0	9·0	9·0	9·0	15·2	11·0	10·0	9·0
Interorbital width	9·0	12·2	16·0	16·0	14·0	14·0	11·0	26·0	18·0	14·0	12·4
Length of snout	8·0	11·2	15·0	15·0	12·5	12·3	10·5	21·2	16·0	13·0	11·5
Length of nasal barbel ...	21·0	27·0	18·0	16·0	17·0	18·0	17·0	22·0	19·0	16·0	16·0
Length of maxillary barbel ...	25·0	30·0	22·1	22·0	20·0	20·0	21·5	30·0	22·0	17·5	21·0
Length of outer mandibular barbel	22·0	28·0	19·0	18·0	18·0	18·0	18·0	26·0	20·0	17·0	17·0
Length of inner mandibular barbel	23·0	29·0	20·0	19·0	19·0	19·0	18·5	27·0	21·0	18·0	17·0
Length of pectoral spine ...	23·0	35·0	34·0	35·0	31·0	29·0	26·0	damaged	38·0	33·0	30·2
Least height of caudal peduncle ...	11·5	15·0	18·0	18·0	14·5	14·5	13·8	30·0	20·8	19·0	18·0

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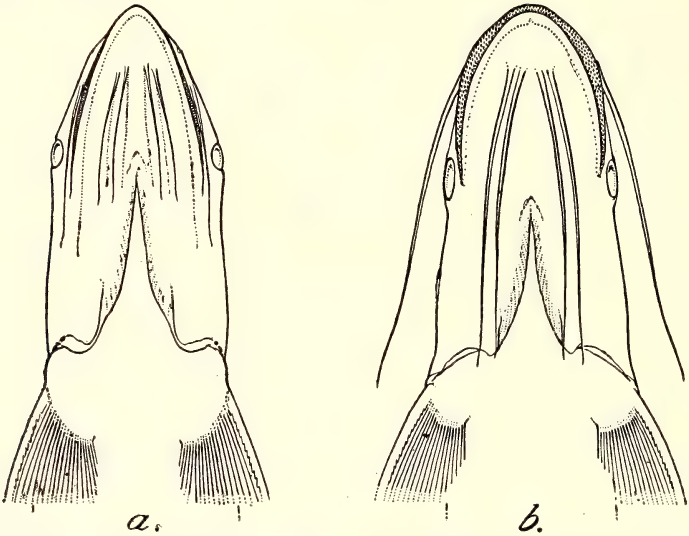
[1] Two more tables of measurements are given on pages 441 and 442.

systematic position of this variety becomes very doubtful, and it seems probable that there are some errors in the description.

Prashad and Mukerji (18) observed that

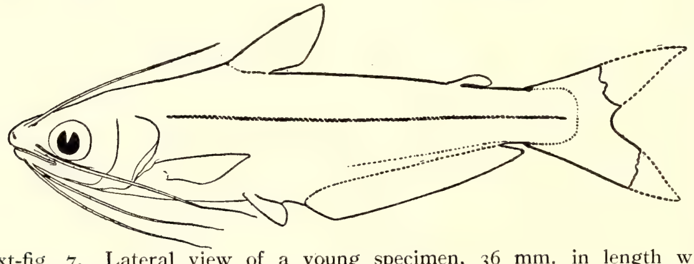
> 'in addition to Day's *E. burmanicus* there are two more or less distinct forms of *E. vacha* and which can be easily distinguished by their different facies. In the first form the snout is very sharp and pointed and the barbels are short, while in the second form the snout is blunt and more or less rounded and the barbels, though shorter than those of *E. burmanicus*, are considerably longer.'



Text-fig. 6. Ventral surface of head and anterior part of body of a long-snouted and a blunt-snouted specimens of *Eutropiichthys vacha* (Ham.).

a. Long-snouted specimen from Chittagong Nat. size; *b*. Blunt-snouted specimen (*A.S.B. Cat.* 484). × 1⅓.

In the old collection of the Indian Museum there are specimens (A.S.B. Cat., Nos. 484, 486 and Dup. Cat., Nos. 161, 246) which have a blunt snout and somewhat longer barbels. The locality of the first two specimens is not given, but presumably they also came from Burma. Prashad and Mukerji figure a specimen with a blunt snout and give 'Punjab' as its locality. I have not been able to trace such a specimen in the collection, but it seems probable that they figured one of the old A.S.B. specimens.



Text-fig. 7. Lateral view of a young specimen, 36 mm. in length without caudal, of *Eutropiichthys vacha* (Ham.) from Mirzapore, United Provinces. × 2.

There are three very young specimens from Mirzapore, United Provinces, which throw considerable light on the variations discussed above. In them the barbels are very long, the snout is somewhat blunt and the mouth is not so extensive; the outer margin of the pectoral spine is distinctly roughened. These features show that some of the Burmese specimens, characterised by longer barbels and a blunt snout, have preserved the juvenile characters of the species to a certain extent.

The study of a large number of specimens has also shown that in several respects the Siamese and Burmese specimens represent a distinct race, and in this connection attention may be directed to the forms of *Crossochilus latius* (Ham.) and *Labeo dero* (Ham.) that have been differentiated by Mukerji (**17**) and Hora (**14**). It would thus appear that though there is a general similarity between the fauna of India and Burma, the two have remained isolated from each other for a sufficiently long period to have evolved into distinct races. In the case of *Eutropiichthys vacha* I have collected a considerable amount of material from the river Hooghly, but only a few specimens are available for study from Siam and Burma on the one hand, and from the north-western parts of India on the other. It is not possible, therefore, to recognise here any distinct races or subspecies of *Eutropiichthys vacha.*

In order to indicate the probable differences between the Burmese and Indian specimens I give below a table of measurements of two equal-sized specimens, one from Siam and the the other from Calcutta (fig. 5).

Measurements in millimetres.

	Siam	Pulta, Calcutta
Total length	310·0	310·0
Length of caudal	58·0	56·0
Length of head	60·0	57·0
Width of head	31·2	31·2
Height of head	40·0	40·0
Diameter of eye	14·0	13·5
Length of snout	19·0	19·5
Interorbital distance	19·0	20·0
Width of body	20·0	29·0
Height of body	51·0	56 0
Length of nasal barbels	28·0	21·0
Length of maxillary barbels	30·0	21·5
Length of outer mandibular barbel... ...	28·0	21·0
Length of inner mandibular barbel ...	29·0	21·3
Length of pectoral spine	47·0	46·0
Least height of caudal peduncle	19·0	24·0

A comparison of the measurements distinctly shows that in the Siamese specimen the head, the pectoral spine and the caudal fin are longer, the barbels are relatively much longer and the eye is larger; but the body is very slender, both in height and in width.

There are in the collection before me two other specimens of equal length, one from the Myitkyina District, Upper Burma and the other from Beas in the Punjab. A table of their measurements is given below.

Measurements in millimetres.

——	Myitkyina	Beas
Total length excluding caudal	220·0	220·0
Length of head	46·0	44·0
Height of head	34·0	35·0
Width of head	25·0	27·0
Width of body	18·0	24·0
Height of body	49·0	53·0
Diameter of eye	12·0	11·5
Interorbital width	17·0	18·0
Length of snout	16·0	16·0
Length of nasal barbel	29·0	18·0
Length of maxillary barbel	31·5	20·0
Length of outer mandibular barbel	22·0	19·3
Length of inner mandibular barbel	24·0	22·0
Length of pectoral spine	40·0	38·0
Least height of caudal peduncle	19·0	21·0

Here again, we find the same differences between the Punjab specimens and the Burmese specimens as are noticed above between the Siam and the Pulta specimens. Further, it has to be noted that in the Siamese and Burmese examples the ventral fins are situated opposite the dorsal, whereas in the Indian specimens the dorsal is in advance of the ventrals.

BIONOMICS AND FISHING NOTES.

Thomas (**23**), who was chiefly familiar with the South Indian forms, makes no reference to *Eutropiichthys vacha*, though he gives an account of *Garua Butchwa*. Lacy (**16**) gives a general account of *Butchwa* and indicates that it 'belongs to two genera, *Eutropiichthys, Pseudeutropius*'. I think, however, that he is mainly dealing with the latter and not with the true *Bāchchā,* for *Eutropiichthys* is not so common in the Punjab rivers as *Clupisoma.* Dhu (**10**) also gives short notes on *Batchwa* or *Butchwa* but he makes no distinction between *Eutropiichthys* and *Pseudeutropius* (including *Clupisoma*) and recognises 'several species of Butchwa in India, *P. garua* (and *P. murius* the cherki) being probably the best known'. The following quotation from Dhu will show the great confusion that centres round the application of the name *Butchwa*:

> 'There are some seven species of this fish in India. Lately a certain amount of controversy seems to have arisen as to what name Pseudeutropius Garua—undoubtedly the most sporting member of the family—should go by. T. P. Luscombe—of the Tackle makers of that name at Allahabad—, whose knowledge of Indian angling is very extensive, calls "Garua" the Baikiri and "Vacha" the Butchwa. And he states :—"Garua" is a surface feeder—good

eating—and generally of a blue and white colour with a large gaping mouth with an upward slant. "Vacha" is a bottom feeder of a light sea green in colour, has four barbels on mouth, which is rather small and round, and not a nice fish to eat."—Here we have more than one Richmond in the field! I do not know on what authority Luscombe fixes the names. I have referred the matter to more than one reputed ichthyologist, but can get no one to take the responsibility of making a definite statement on the subject! Day, our greatest authority on Indian fish, gives as vernacular names:—"Butchwa" and "Nandi Butchwa" for E. Vacha, and calls P. Garua "Poonia Butchwa". That the two fish may be caught in the same waters, and that confusion is liable to arise, the notes on Narora, of Captain Tate, bear out. However until the matter is definitely settled, I let the name stand, as the Butchwa is so familiar a name to many anglers in this country, and so long as fishermen realise that other low class relations may lay claim to the title of Butchwa or Baikiri, they are sufficiently safeguarded in describing their catches.

'He is a game little fish running up to 2 lbs. in weight, who will take either fly (lake trout size) or small spoon.

'He is only to be found in the rivers of Northern India. One excellent thing about him is that he will take in coloured water, in fact the time to fish for them is between March and November, when Mahseer fishing is out of the question. They have small teeth which cut one's gut occasionally, so examine your snoods from time to time.'

From an angler's point of view it seems highly desirable to clear the confusion about the popular nomenclature of the species, and for this purpose we cannot do better than to refer to the original sources. Hamilton (**13**) who introduced *Eutropiichthys vacha* in scientific literature for the first time has left behind extensive manuscript notes on the fish and fisheries of the districts he visited. These notes were published by Day (**7**) and therein we find the following particulars about this fish.

Dinajpur District, p. 29—'Váchá, Pimelode, a fish about the size of a herring, and considered as very good by the natives.'

Rangpur District, p. 44—'The Váchá of Goálpárá, Calcutta and Dinájpur; the Kángon of Lakshmípur.'

Purniah District, p. 60—'Kátlá. This must be carefully distinguished from the Kátal of the Bengalis, at Calcutta, usually called Kātlā, which is a species of Cyprin, very common in Ganges and Mahánandá, but scarcely ever found in the Kusí.'

Bhagalpur District, p. 76—'The Băchoyā is another Pimelode, called Váchá in Bengal, and Kátlá at Náthpur.'

Patna District, p. 88—'The Pimelodes called Băchoyá at Monghir, at Patná is called Sŭgwábăchoyá.'

In his description of the species Hamilton (**13**) notes:

'The *Vacha* is common in all the larger fresh water rivers of the Gangetic provinces, grows to about a foot in length, and is an excellent fish for the table.' The mouth is described as 'very large, and descends, with a little obliquity, from the extremities of the head below the eyes.'

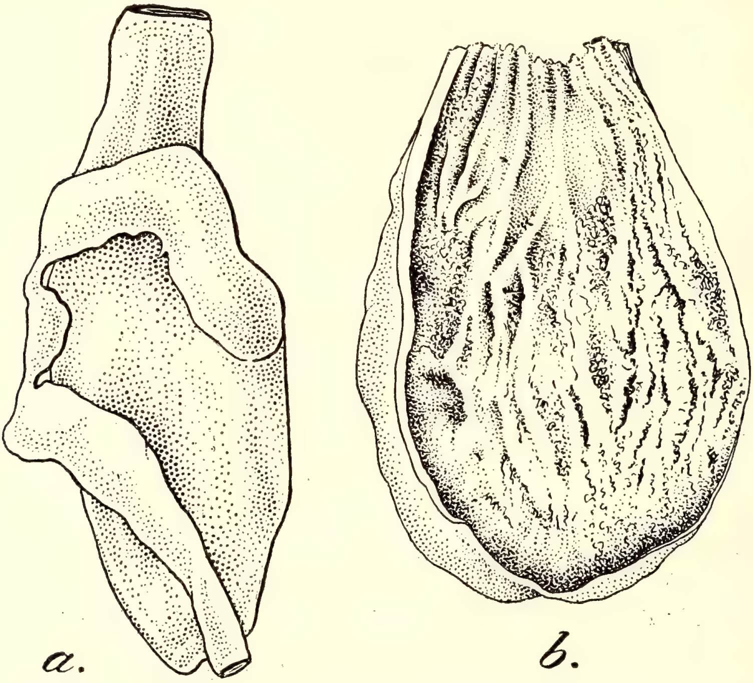
The above observations leave no doubt about the identity of *Butchwa,* and from the nature of its mouth it can be readily distinguished from *Garua.*

Day also notes that it is good eating. According to Beavan (**1**), 'It rises readily to a fly, and affords good sport.'

Dhu (**10**) in his account of fishing at Narora (pp. 482-491) makes several references to *Butchwa.* Writing of pools below the falls he says (p. 484):

'There, too, morning and evening when the Butchwa are on the feed, which will soon be apparent by the water seeming to boil as they chase and scatter the fry, very good bags may be made by using a fly-spoon or a fly (lake trout or small salmon size). If the near or far gates are shut down, and you can get along the top of the fall, and mount on to one of the aforementioned piers, this is an excellent place to fish from, and very pretty sport may be had with the Butchwa and trout, especially the latter, using a light rod and fly-spoon . . . And catching Butchwa and Barilius bola thus side by side, one is able to make a very fair comparison of the two fish, and there is no doubt that weight for weight the trout puts up the finer fight. But from an edible point of view he is a very bad second. Using a lake trout size fly is really the best sport, as the fish take it greedily, and thus lightly hooked made a great fight of it.'

In the form of its body and the large ascending mouth *Bāchchā* corresponds with the 'Indian Trout', and from the above it seems that it can be fished with the type of tackle ordinarily used for fishing *Barilius bola* (Ham.).



Text-fig. 8. Alimentary canal of *Eutropiichthys vacha* (Ham.) × 1½.
a. The whole of the alimentary canal; *b.* The stomach cut open to show the nature of its internal wall.

It is a very voracious fish and mainly feeds on other smaller fish or insects. Its alimentary canal is short and the stomach is very capacious. The walls of the stomach are raised into longitudinal folds.

In the river Hooghly boat-loads of *Bāchchā* and *Garua* were found about 40 miles above Calcutta. The two species occurred in almost equal numbers, and both were found by experience to be good eating. It seems that in nature the two species do not compete for food; the former feeds near the surface while the latter feeds near the bottom. From the abundance of both types of fish in the *Kachha* settling tanks of the Calcutta Corporation Water Works at Pulta it seems certain that the fish can be acclimatised to lakes, large tanks and bheels. The food is so plentiful in the Corporation tanks that the largest specimen I have seen, about 16 inches in total length, was captured from there. These tanks get a continuous supply of fry of all kinds from the water of the river that is pumped into them, but in ordinary tanks *Eutropiichthys* may prove very destructive to other smaller fish, and, therefore, its culture cannot be recommended.

Ordinarily *Bāchchā* grows to about a foot in length and attains a weight of about a couple of pounds. Prashad and Mukerji (**18**) state that 'It is said to inhabit the deeper parts and to grow to a weight of about 30 lbs.' It seems unlikely, however, that the fish attains this weight in Burma. The largest specimen they had was about 13 inches in total length.

ACKNOWLEDGMENTS.

The Bombay Natural History Society very kindly made a grant towards the cost of illustrations and for this I have to offer my sincere thanks to the authorities of the Society. Mr. K. S. Misra, M.SC., my assistant in the Zoological Survey of India, has helped me in the preparation of the tables of measurements and for this I am very grateful to him. The illustrations were prepared by Babu B. Bagchi, with his usual skill and care.

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EXPLANATION OF PLATE.

Lateral view of a Chittagong specimen of *Eutropiichthys vacha* (Hamilton). × *ca.* $\frac{3}{4}$.

The specimen and a rough colour sketch were supplied by the late Babu A. C. Chowdhary, a retired artist of the Zoological Survey of India.

THE VERNAY SCIENTIFIC SURVEY OF THE EASTERN GHATS.

(Ornithological Section).

BY

Hugh Whistler, M.B.O.U., assisted by N. B. Kinnear, M.B.O.U.

Part XVI.

(*Concluded from page 263 of vol.* xxxix).

Pelecanus onocrotalus Linnaeus.

Pelecanus onocrotalus Linnaeus, Syst. Nat. ed. x, vol. i (1758), p. 132—Caspian Sea.

There is very little evidence as to the occurrence of the Roseate Pelican within our limits and it usually rests on a specimen from 'Madras' (Jerdon) in the British Museum. This however may now be supplemented by the sight record[1] of two birds in the backwater of Vizagapatam in October 1923, and a specimen seen and later obtained at Konda-Kerla, a lake 18 miles south of Vizagapatam (Law, *J.B.N.H.S.*, xxx, 483).

The student is reminded that Captain C. H. T. Grant has pointed out that this species cannot properly be divided into two races either on size or number of tail-feathers, the alleged differences being doubtless due to age and individual variation. He has also shown that the name *Pelecanus roseus* of Gmelin belongs rightly not to the Roseate Pelican but to the Spot-billed Pelican (*Bull. B.O.C.*, vol. lv, 1935, p. 63).

The Pelicans and the remaining birds on our list are practically unrepresented by any fresh material in the Survey. I have therefore not made any original investigations into the races of the species that follow and merely accept the races and names as given in the *New Fauna*.

Pelecanus roseus Gmelin.

Pelecanus roseus Gmelin, Syst. Nat. vol. i, pt. 2 (1789), p. 570—Manilla, Luzon, Philippine Islands.

Jerdon informs us (*B. of I.*, iii, p. 860) that he visited one colony of the Grey or Spot-billed Pelican in the Carnatic where the birds had for ages, according to his informants, built on low trees in the middle of a village, caring little for the close and constant proximity of human beings. The comment in the *Old Fauna* (iv, 336) that there was no late authentic account of Pelicans breeding in India led to the appearance in the *Journal* of two fresh records. In vol. xiv, p. 401 Howard Campbell described how in March 1890 in a secluded valley in the extreme east of the Cuddapah district he had found several hundreds of nests on neem and tamarind trees in a small village called Buchupalle. The nests all apparently contained young.

A second colony was described by C. E. Rhenius (*J.B.N.H.S.*, xvii, 806) at Kundakolam in the Nunguneri Taluq of the extreme south of the Tinnevelly district. On 8 June the nests all contained young, including many birds able to fly.

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[1] It will be remembered that the identity of the Pelicans occurring in the Presidency is based almost entirely on sight records which can hardly be considered satisfactory.

In both these colonies the birds were breeding in association with the Painted Stork (*Ibis leucocephalus*) and were strictly protected by the villagers.

The only other information I can trace about the Spot-billed Pelican in the Presidency is a specimen from Tada, Nellore District, said to be in the Madras Museum and Ferguson's statement that it occurs in S. Travancore where he once saw three flying over the parade ground in Trivandrum.[1]

Phalacrocorax carbo sinensis (Shaw).

Pelecanus sinensis Shaw, Nat. Misc., xiii (1801), pl. 529 text—China.

The Cormorant is said by Annandale[1] (*Rec. Ind. Mus.*, xxii, 328) to visit Barkuda Island on the Chilka Lake occasionally.

Terry (apud Hume *N. & E.*, iii, p. 271) describes the nesting of the cormorant on a large tank some thirty or forty miles from Bellary near the Madras railway. Some six or seven pairs were nesting on some small rocks in the centre of the tank and had both eggs and young on 17th January.

Major Bates informs me that he could only find two pairs breeding in the famous heronry of Veden Thangul described in Hume's *N. & E.*, iii, p. 238 (*rectius* Vedan Thangal near Pudupattu).

An account of their nests will be found in Bates' *Bird Life in India*, p. 37. In 1928 a female was brooding chicks on December 20th and these were nearly ready to fly on January 13th. In 1929 the nests contained eggs on December 29th and the young were still in down on February 16th.

Jerdon's statement that he had seen it on the 'wooded Bhowany' at the foot of the Nilgiris complete the records for the Presidency. No Presidency specimens are available for examination.[2]

Phalacrocorax fuscicollis Stephens.

Phalacrocorax fuscicollis Stephens in Shaw's General Zool., vol. xiii, pt. I (1826), p. 91—Bengal.

Very large numbers of the Indian Shag are to be found on the Chilka Lake according to Annandale (*Records Ind. Mus.*, vol. xxii, pt. iv, No. 23 (1921), p. 328. It breeds in enormous numbers on Kalidai, the sacred island, and the young birds are nearly fledged by the end of October.

There is a specimen from Tada, Nellore District in the Madras Museum and according to Finn some are to be seen on the Red Hills tank near Madras. Captain Packard found them breeding in numbers at the Vedan Thangal tank on December 1st, on which date there were eggs (*J.B.N.H.S.*, xv, 138).

Jerdon's statement that he procured the Indian Shag in the Carnatic completes my information from the Presidency and I have seen no specimens from there.

Phalacrocorax niger (Vieillot).

Hydrocorax niger Vieillot, Nouv. Dist. Hist. Nat., nouv. éd., vol. viii (1817), p. 88—East Indies = Bengal.

The Pygmy Cormorant is found on the Chilka Lake (Annandale, *Records Ind. Mus.*, xxii, 328). There is a specimen from Tada, Nellore District, in the Madras Museum and Dewar says that it is abundant on most of the large sheets of water round about Madras.

In the Vedan Thangal Heronry the Pygmy Cormorant breeds in great numbers and a good account of it there will be found in Bates' *Bird Life in India,* pp. 20-47. In a private note that he gave me Major Bates estimated that in 1928 and 1929 the Pygmy Cormorants composed about two-thirds of the total population of the colony which was not under 5,000 birds. In 1928 most of the nests on December 20 contained young ones in all stages of growth, though the largest were still in down. In 1929 on December 29th very few eggs were even hatched.

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[1] It will be remembered that in the Madras Presidency, although a certain amount of rain falls at odd times throughout the year, it is only after the breaking of the North-east monsoon that water collects in the numerous tanks constructed for irrigation of the rice fields and gives the signal for the breeding of the various Pelicans, Storks, Herons, Ibises etc. The monsoon may break towards the end of September or not until late October or even early November. The nidification of these birds may consequently be in very different stages on any particular date in two consecutive years.

[2] In the water birds that follow I have included these records of the Chilka Lake as it borders on the Presidency and must throw light on conditions in the northern Circars.

On the western side of the Presidency William Davison thought he saw a party flying high overhead in the evening at Manantoddy and Ferguson states that he had seen it on the tanks and lakes in and about Nagercoil.

There are three specimens labelled 'Madras' without proper date in the British Museum.

Anhinga melanogaster Pennant.

Anhinga melanogaster Pennant, Indian Zool. (1769), p. 13, pl. 12—Ceylon and Java.

According to Annandale (*Records Ind. Mus.*, xxii, 328) the Indian Darter is not uncommon on the Chilka Lake and Jerdon calls it not very uncommon in the Northern Circars. Dewar includes it in his Madras list without comment and there is a female from Madras in the British Museum collected on June 9th by Wardlaw Ramsay as well as a specimen from Chingleput in the Madras Museum. In the Vedan Thangal Herony Bates (*Bird Life in India*, p. 39) found it scarce, only about half a dozen pairs being found there in both years. Newly hatched young were noted on 7 February 1929. Hume says (*N.* & *E.*, iii, 274) that in the country south of Madras this species lays in January or February.

On the western side we have William Davison's statement that he obtained the Darter on the Pykara river about 9 miles from Ootacamund and that he had also noticed it in the Wynaad. Mr. Betts informs me that he also saw a single bird on the Pykara river on several occasions, spread over three years. It was always on the same stretch of water. In Travancore, according to Ferguson, it is common on all the larger fresh water lakes. It is abundant on the lake formed by the Peryár dam at 3,000 ft. in the hills and equally common on the Sastancotta lake in the low country. Bourdillon describes a colony found nesting about the Athirapuzha fall of the Kodasheri river in September.

Sula leucogaster plotus (Forster).

Pelecanus plotus Forster, Descr. Anim. (ed. Licht.), 1844, p. 278—Near New Caledonia.

Under the name of *Sula fiber* Jerdon states that he received a specimen of the Booby from the Malabar coast, but this specimen is no longer in existence. The record may, however, be accepted as this bird has been obtained on several occasions on the coast of Ceylon.

Sula dactylatra melanops Heuglin.

Sula melanops Heuglin Isis, 1859, p. 351, pl. x, figs. 1 and 2—Burda Rebshi, Somali coast.

The occurrence of the Masked Booby on the Presidency coast rests on a young female which was obtained by Colonel H. R. Baker at Cannanore on 19 July 1911 (*J.B.N.H.S.*, xxi, 272). It was found sitting on the cliff and was killed by a servant with a stick, its occurrence being doubtless due to 'the heavy gales we have experienced lately.' This specimen is now in my own collection and I have compared it at the British Museum. It is in immature plumage and there is no specimen in quite the same stage in the British Museum but I think it may be correctly attributed to the above race. This record was overlooked by the *New Fauna.*

Fregata andrewsi Mathews.

Fregata andrewsi Mathews, Austr. Av. Rec. vol. ii (1914), p. 120—Christmas Island, Indian Ocean.

Jerdon long ago stated (*B. of. I.*, iii, 853) that he had received a specimen of the Frigate-bird, 'in young plumage' which was shot on the Malabar coast off Mangalore. He recorded it as *Attigen aquilus* but as he then only recognised two species, the actual identity of his specimen remains in doubt.

In *J.B.N.H.S.*, xxxiii, 445, Mr. Prater, however, records a specimen of this species presented to the Society by Mr. L. A. Lampard. It was caught in a fishing net in a rough sea at the onset of the monsoon off the coast of Quilon, Travancore.

Fregata ariel (G. R. Gray).

Atagen ariel G. R. Gray, Genera Birds, vol. iii (1845), col. pl. 183—Raine Island fixed as type locality by Mathews [Birds of Australia, vol. iii (1914), p. 285].

Ferguson states that an immature specimen of the Smaller Frigate-bird was taken at Perumathoray about 10 miles from Trivandrum and brought to him alive (*J.B.N.H.S.*, xvi, 13).

[**Puffinus**

There can be little doubt that various species of Petrels and Shearwaters occur off the coasts of the Madras Presidency but there are as yet only three records and the exact species to which they refer are as yet unknown.

The best known record is that of Jerdon *Birds of India*, vol. iii, p. 826—'Two species of Petrel have been observed by myself, of only one of which I obtained a specimen, from the neighbourhood of Madras, where I had, on several occasions, observed it not far from the shore, during rather rough weather; I lost this, however, before an accurate description was taken, and I can only say that I suspect it belongs to the Division *Æstrelateæ*, of Bonaparte and probably to the Genus *Petrodroma*, Bonap.: indeed, it appeared to be very similar to *P. macroptera* of Dr. A. Smith, figd. in Zool. South Africa, Birds, pl. 50. It was entirely of a dull sooty-brown colour, palest beneath; length nearly 18 in.; wing 12½; tail 5; bill at gape nearly 1¾ in. In the *Old Fauna* this was doubtfully identified as *Puffinus chlororhynchus*.

Blanford in the *Old Fauna* (iv. 358) remembered when on his way from Calcutta to Madras by steamer in 1867, seeing several small petrels (apparently without white rumps) only a few yards away from the vessel. They were probably of the genus *Oceanodroma*.

Finally Ferguson (*J.B.N.H.S.*, xvi, 14) says that a single specimen of a Shearwater, which he calls *Puffinus persicus,* was taken at Valey, 4 miles from Trivandrum, and brought to him alive.

Observers at the ports of the Presidency are urged to make an endeavour to secure such specimens of these birds as may be caught by fishermen out at sea. It must however be realised that the correct identification of these birds is a matter of great difficulty and care should be taken to have any specimens procured examined by a competent authority on the group.]

Daption capense (Linnaeus).

Procellaria capensis Linnaeus, Syst. Nat. ed. x, vol. i (1758), p. 132—Cape Seas.

The Cape Pigeon may be by courtesy included in the Presidency list as a straggler. Hume received through Mr. H. R. P. Carter from Mr. Theobald a specimen killed between Ceylon and the main land in the Gulf of Manaar. It is now in the British Museum (*Ibis*, 1870, p. 438 and *S.F.*, vii, 463).

Platalea leucorodia Linnaeus.

Platalea leucorodia Linnaeus, Syst. Nat. ed. x, vol. i (1758), p. 139—Europe.

The Spoonbill appears to have been recorded only from the Eastern side of the Presidency and even from there I have seen no specimens.

Mr. D. Hatchell found a nest with young amongst rushes in the Kolair Lake (*Birds of S. India*, p. 438) and this is of special interest in view of the statement in *Nidification,* iv, 435 that the nesting in reeds of this species has not yet been recorded in India.

According to Dewar the Spoonbill is not common in the neighbourhood of Madras but there is a specimen from Pulicat in the Madras Museum.

The Spoonbill was not included in the list of species breeding at Vedan Thangal as furnished to Hume (*N. & E.*, iii, 238). Bates, however, in *Bird Life in India*, p. 41, estimates the number of Spoonbills at the colony as not less than 300 or 400 pairs and says that they were on the whole the latest birds nesting, which perhaps explains their absence from the earlier account. In 1929 the majority of their eggs were only just hatching on February 7 and in the following season (1929-1930) only two nests were found to contain eggs by December 29th and no eggs had hatched by February 16th.

Threskiornis melanocephala (Latham).

Tantalus melanocephalus Latham, Ind. Orn., ii (1790), p. 709—India.

The White Ibis is not uncommon on the Chilka Lake according to Annandale (*Records Ind. Mus.*, xxii, 329), but I can trace no other record of it on the eastern side of the Presidency except at Vedan Thangal, where Hume's correspondent (*N. & E.*, iii, 238) implied that it was one of the common species in that Heronry. It was not one of the five species present when Captain Packard visited Vedan Thangal in 1902 (*J.B.N.H.S.*, xv, 138). However Major Bates found it in both seasons 1928-1929 and 1929-1930. The first season he estimated that about ten pairs were present and there were eggs in some nests on December 20th, the young being able to clamber about the branches of the trees by February 7th. In the season 1929-1930 the number were estimated at about 60 or 70 pairs. Most of the nests had eggs on December 29th, though two were found with newly hatched young. In other words, Bates points out, nidification was at the same stage in both years with this species, which was not the case with any other species at the colony (*Bird Life in India*, p. 39).

In Travancore Ferguson says he has only seen the White Ibis in the cold weather at Sastancotta and doubts whether it is a resident in the State. They feed by day in the paddy fields and are difficult to approach, but generally roost in trees on the banks of the lake.

No specimens are available for examination.

Pseudibis papillosa (Temm. and Lang.).

Ibis papillosa Temm. and Lang. Planch. color. d'ois. livr. 51 (23 October 1824), pl. 304—no locality (India).

Mr. Hatchell of the Madras Survey Deptartment reports having shot a couple of Black Ibis out of a flock of eight at Peddangopavaram in the Nellore District in November 1902 (*Birds of S. India,* p. 440). Otherwise the bird is recorded in the Presidency only from the Wynaad where William Davison says he found flocks frequenting the trees bordering the banks of the river at Manantoddy in April 1881. They were exceedingly noisy and Davison thought they were preparing to breed.

Plegadis falcinellus (Linnaeus).

Tantalus falcinellus Linnaeus, Syst. Nat., ed. xii (1766), p. 241—Austria and Italy.

The only records that I know of the Glossy Ibis in the Presidency are furnished by three specimens in the British Museum, namely a male and female from 'Madras' and a female from Coimbatore, October 31. All of these are in the Hume collection.

Ciconia ciconia (Linnaeus).

Ardea ciconia Linnaeus, Syst. Nat. ed. x, vol. i (January 1758), p. 142—Sweden.

There is very little information about the White Stork in the Presidency. Law (*J.B.N.H.S.*, xxx, p. 483) mentions seeing a group of about half a dozen resting by a channel of the Vizagapatam backwater in October 1923.

On the western side two were obtained from a shikari by Mr. G. A. R. Dawson of Coonoor (*S.F.*, x, 415) in October 1870. They were said to have been shot from a flock of 18 which were feeding on open grassland near the sandy vale between Ootacamund and Pykara.

Dissoura episcopus episcopus (Boddaert).

Ardea episcopus Boddaert, Table Pl. Enlum. (1783), p. 54 for Pl. Enl. 906—Coromandel coast.

The White-necked Stork occurs on the Chilka Lake according to Annandale (*Records Ind. Mus.*, xxii, 329). Dewar includes it in his Madras list without comment and Colonel H. R. Baker (*Birds of S. India*, p. 445) says he has seen it in flocks on the shallow tanks outside Trichinopoly and in the paddy fields near the river which runs parallel to the railway between Shoranur and Calicut. William Davison saw a pair on a dead tree on the river bank at Manantoddy, Wynaad. Colonel Baker shot a female on 21 December 1921 in a swamp on the top of the Sigur Ghat near Ootacamund but this appears to be the only record for the Nilgiris. This specimen is now in my collection.

In Travancore Ferguson had information of only two specimens. One was obtained on the banks of the river at Palode. The other was brought in alive, taken on the bank of a tank near Nagercoil.

There is nothing to show the status of the White-necked Stork in the Presidency.

Xenorhynchus asiaticus asiaticus (Latham).

Mycteria asiatica Latham, Ind. Orn. vol. ii (1790), p. 670—India.

According to Annandale (*Rec. Ind. Mus.* xxii, 329) the Black-necked Stork occurs on the Chilka Lake. Otherwise there is no record of its occurrence in the Presidency beyond Dewar's inclusion of it, without comment, in his Madras list.

Leptoptilos javanicus (Horsfield).

Ciconia javanica Horsfield, Trans. Linn. Society, vol. xiii, pt. i, May 1821), p. 188—Java.

The Lesser Adjutant is confined in the Presidency to the south-west where Ferguson says it is by no means common, but may be found about the tanks in South Travancore. Live specimens were brought in to him for the Zoological gardens from time to time. No doubt it was this area that Jerdon had in mind when he said he had only seen it in Southern India on the Malabar coast. An immature bird from 'Madras' (Jerdon) is in the British Museum.

Ibis leucocephalus (Pennant).

Tantalus leucocephalus Pennant, Ind. Zool. (1769), p. 11, pl. 10—Ceylon.

The Painted Stork is recorded only from the Eastern side of the Presidency. Ball (*S. F.*, v, 420) says that he not infrequently saw flocks on the Jaipur (Jeypore) plateau. Howard Campbell found large numbers breeding with Pelicans in a secluded valley in the extreme east of the Cuddapah district in a small village called Buchupalle. This was in 1890 and at the end of March all the nests contained young though he found one clutch of hard set eggs (*J.B.N.H.S.*, xiv, 401).

There is some mistake about the statement (*Nidification*, iv, 450) that Bates found this species breeding near Madras. He did not do so and it has not been recorded in the Vedan Thangal Heronry.

Finally Mr. C. E. Rhenius (*J.B.N.H.S.*, xvii, 806) found another large colony, again breeding with Pelicans, in the extreme south of the Tinnevelly district. This was at Kundakolam in the Nunguneri Taluq. On 8 June there were young in various stages of development.

Anastomus oscitans (Boddaert.).

Ardea oscitans Boddaert, Table Pl. Enlum, p. 55 (1783) for Pl. Enl. 932—Pondicherry, India.

Mr. D. Hatchell states that the Open-bill is common in the Nellore District (*Birds of S. India*, p. 448).

Our main information about this curious bird in the Madras district, however, comes from the Vedan Thangal Heronry where the first account of its nesting was published in Hume's Rough Draft in 1873. It will be remembered that Major Bates was able to trace by documentary evidences the existence of this Heronry as far back as the years 1796-1798 (*Bird Life in India*, p. 29).

In 1903 the Heronry was again described by Captain H. N. Packard (*J.B.N.H.S.*, xv, p. 138) who visited it on December 1st 1902. On that date the eggs of the Open-bill were in all stages of incubation and the adults without exception were all in the grey plumage (a statement that suggests that the *New Fauna*, vi, p. 333 is wrong in calling this the non-breeding plumage).

Bates visited the Heronry again in the seasons 1928-1929 and 1929-1930. The first winter all the Open-bills had young on December 20th, some being sufficiently old to look capable of flight by December 29th. Numbers were actually on the wing by January 13.

In 1929-1930 the very largest young were not as large as chickens by December 29th. These were capable of flight by February 16th but on that date newer arrivals in the colony were still only laying eggs. The total number of adults at the colony this season were estimated by Baker as about 200 birds in all.

Where these birds spend the non-breeding season is not clear unless it is in Travancore. Bates, however, on three separate occasions—viz. 5 March 1924, 29 March 1929 and the very end of April 1930—saw birds flying over St. Thomas' Mount and these he presumed were birds leaving the Heronry.

In Travancore, according to Ferguson, the Open-bill is very common and large flocks may be met with on the marshy borders of all the larger tanks and fresh water lakes. He did not, however, find any evidence of breeding.

Ardea purpurea manilensis Meyen.

Ardea purpurea var. *manilensis* Meyen, Nova Acta Acad. Leop. Carol., vol. xvi, Suppl. (1834), p. 102—Philippines.

The Purple Heron is no doubt very generally distributed in the Presidency. Mr. Hatchell reports specimens shot at Bhimadole in the Godaveri District, at the Nagathur canal, Kurnool District, and at Dharmapuri, Salem District (*Birds of S. India*, p. 450). It occurs without comment in Dewar's Madras list and Captain Packard (*J.B.N.H.S.*, xv, 139) found it breeding at Vedan Thangal on December 1st 1902. He then estimated that perhaps 8 or 10 pairs were present in the Heronry—this species usually nests in reed beds—though they were so shy that he had great difficulty in identifying their nests and only managed to satisfy himself in one case. None appear to have been found by Bates on his visits to this colony.

On the western side the country is less suitable for the Purple Heron but Hume received a specimen for identification shot somewhere about the base of the Nilgiris (*S.F.*, x, 416). In Bourdillon's time it was abundant at the Vellarney Lake 7 miles from Trivandrum whence there is a female (June 21, Bourdillon) in the British Museum. When Ferguson wrote however the reeds had gone and with them of course this species, which however he shot at Sastancotta. In Travancore according to Bourdillon and Ferguson, the breeding season was in July and August (Stuart-Baker, *Nidification*, iv, 456).

Ardea cinerea rectirostris Gould.

Ardea rectirostris Gould, P.Z.S., 1843, p. 22—New South Wales.

The Heron is common on the Chilka Lake according to Annandale (*Rec. Ind. Mus.*, xxii, 329) and it breeds there on some of the islands in September. Dewar includes it in his Madras list without comment.

This species breeds at the Vedan Thangal Heronry and is mentioned there before 1873 by Hume's anonymous correspondent, though without any particular details being vouchsafed. Packard evidently found it common at the Heronry and eggs were hatching on December 1st (*J.B.N.H.S.*, xv, 139). Bates also found the Herons numerous and considered them the earliest of the breeders in the colony. All—but a few stragglers—had finished and left by the end of February in the season 1928-1929. Next season he noted that many eggs had hatched and a few young were already feathering by December 29.

On the western side our only information is from Ferguson who says that in Travancore the Heron frequents the backwaters along the coast but is not found in the interior. A captive bird in the Public Gardens had lived for over 17 years! There is a Travancore skin (Bourdillon: no data) in the British Museum.

Egretta alba modesta (Gray).

Ardea modesta Gray, Zool. Misc. (19 February 1831), p. 19—India.

The Great White Heron is found on the Chilka Lake according to Annandale (*Records, Ind. Mus.*, xxii, 329) and Dewar includes it without comment in his Madras list, but I do not find any other record of this species from the Eastern side of the Presidency. The original account of the Vedan Thangal Heronry appears under this species in Hume's Rough Draft (p. 614) and is copied again under it in Stuart Baker's Nidification (iv, 459). It will be noted, however, that the name of this species—as distinct from other Egrets—does not actually occur in the account and Bates appears to have found only the Little Egret at the colony.

On the western side the Great White Heron is only recorded from Travancore whence there is a skin from Kolachul (January, Bourdillon) in the British Museum. Ferguson says that this Heron is by no means common and very wary. At Sastancotta it roosts in company on the trees round the lake.

Egretta intermedia intermedia (Wagler).

Ardea intermedia Wagler, Isis (1829), col. 659—Java.

Annandale implies that the Smaller Egret is not uncommon on the Chilka Lake (*Rec. Ind. Mus.*, xxii, 329) and Dewar includes it in his Madras list without comment. Otherwise it is recorded in the Presidency only from Travancore where Ferguson says it is fairly common about the edges of the backwaters and lakes from Quilon northwards. It is usually seen in companies of 3 or 4 or even more, but is not nearly so abundant in the South.

I do not know the evidence on which Stuart Baker (*New Fauna*, vi, 347) says that 'in Madras and the south they breed during December and January'.

Egretta garzetta garzetta (Linnaeus).

Ardea garzetta Linnaeus, Syst. Nat., ed. xii (1766), vol. i, p. 237—'In Oriente' = Malalbergo, N.E. Italy.[1]

The Little Egret, also, is recorded from the Chilka Lake by Annandale who implies that it is common, while it is included in Dewar's Madras list without comment. It is the common Egret of the Vedan Thangal Heronry and Bates informs me that there were not less than 500 birds standing round the margins of the tank at each of his visits. How many of these birds actually breed in the Heronry is a problem. Packard did not include it in his list of the breeding species. Bates considers that if the Egrets breed at the Heronry at all they do so late in the season, as certainly only a dozen or less were breeding there by early March 1929 while on 16 February 1930 there were only two pairs nesting, one still building, the other still laying. They were certainly not nesting earlier in the season and he has some doubt as to whether they had then even assumed breeding plumage.

In Travancore according to Ferguson the Little Egret is not uncommon about the backwaters of the coast, going about solitary or in pairs.

Bubulcus ibis coromandus (Boddaert).

Cancroma coromanda Boddaert, Table Pl. Enl. (1783), p. 54 for Pl. Enl. 910—Coromandel, India.

The only information that I can trace regarding the Cattle Egret on the eastern side of the Presidency is its inclusion in Dewar's Madras list (doubtless on the strength of the specimen in the Madras Museum) and the statement in the *Old Fauna* (iv, 389)—whose provenance I cannot trace—that the breeding season in the Carnatic is in November and December.

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[1] See Grant, *Bull., B.O.C.*, liii (1933), p. 194.

On the west Fairbank includes it in his Palni list as observed following cattle near the base of the hills. In Travancore Ferguson says that it is far the commonest of the White Egrets, being found in numbers in all paddy fields throughout Travancore along the backwaters and in cultivated lands. He says the breeding plumage is assumed about April. There are an Anjango specimen and another (♀ 13 November, Bourdillon) from Trivandrum in the British Museum.

Demiegretta asha (Sykes).

Ardea asha Sykes, *P.Z.S.*, 1832 (22 November), p. 157—Dukhun.

Very little is known about the Indian Reef-Heron in the Presidency. Colonel H. R. Baker (*B. of S. India*, p. 455) says that he met with it at Cannanore and that Mr. Hatchell records obtaining a possible specimen near Ellore. Ferguson's collectors obtained a single specimen at Ayrentenga, on the coast near Kayankulum in Travancore. There is an old specimen in the British Museum, said to have been obtained by Sykes in the Tinnevelly district and formerly in the India Museum. The status in the Presidency is therefore quite unknown.

Ardeola grayii (Sykes).

Ardea grayii Sykes *P.Z.S.*, 1832 (November 22), p. 158—Dukhun.

Specimen collected :—1739 28-4-30 Anantagiri 3,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1 ♂	70.5	213	78	60 mm.

The Pond-Heron is common on the Chilka Lake according to Annandale (*Records Ind. Mus.*, xxii, 329) and LaPersonne reports, in reference to the above specimen, that at Anantagiri they were found to frequent the hill streams. On this side there is no other information beyond Dewar's inclusion of it without comment in his Madras list.

On the west there is more to set forth. In Coorg Betts says it is widely distributed wherever there are paddy fields, ponds or swamps. In the Wynaad William Davison considered it common and his note on it in the Nilgiris is of interest—'Some years ago this species was rare on the Nilghiris, a few occurring during the cold weather about the lake at Ootacamund, but within the last three or four years it has become quite numerous about the marshy banks of the lake. I counted thirty in the course of a walk one morning. It is, however, only a cold weather visitor to the Nilghiris, disappearing as the breeding season approaches'. According to Colonel H. R. Baker (*B. of S. India*, p. 456) it still occasionally occurs in winter at Ootacamund though I believe one of the lakes has been drained.

In the Palnis both Fairbank and Terry record it, by streams and ponds at the base of the hills according to the former and very abundant in all parts of the district according to the latter. As to Travancore Ferguson states succinctly that it is one of the commonest and most familiar birds throughout the whole country.

The breeding season in the Presidency does not appear to have been recorded.

No proper material is available from the Presidency to verify that South Indian birds are the same as those from Northern India.

Butorides striatus javanicus (Horsfield).

Ardea javanica Horsfield, Trans. Linn. Society, vol. xiii, pt. i (1821 May), p. 190—Java.

The occurrence of the Little Green Heron has not been substantiated on the eastern side of the Presidency beyond the fact that a local specimen in the Madras Museum is apparently the basis for its inclusion in Dewar's Madras list.

On the west William Davison says that he met it on several occasions in the Wynaad but it apparently does not ascend the Nilgiris. Kinloch identified it in the Nelliampathies (*J.B.N.H.S.*, xxvii, 943).

In Travancore it is believed to be a winter visitor only. Bourdillon said that it was to be found from November to March among the rocks of the larger streams up to about 2,000 ft., always in dense jungle. Ferguson said that it was common in the low country from November to April. There are two specimens from Bourdillon in the British Museum. One has no precise data. The other was collected at Merchiston on March 27th.

Nycticorax nycticorax nycticorax (Linnaeus).

Ardea nycticorax Linnaeus, Syst. Nat. ed. x, vol. i (1758), p. 142—South Europe.

According to Annandale (*Records Ind. Mus.*, xxii, 329) the Night Heron is common and breeds on the Chilka Lake. Dewar records a considerable colony on the Red Hills tank near Madras and these birds breed on the islands in the middle of the tank. They were visited on 3 September and most of the young birds were then fledged, though one or two nests still held eggs.

When Packard visited the Vedan Thangal Heronry on December 1st he found the Night Heron in thousands. Some were in very bedraggled plumage —which he attributed to their being engaged with second broods while the young of the first broods were still about the nests.

In the same Heronry Bates found the Night Heron one of the most abundant species, vying only with the cormorants in numbers. Their nidification appears to extend over a longer period than in the case of the other birds, for at his first visit on 20 December 1928 not only did the nests contain both eggs and young but a number of young birds were actually seen in flight. Yet on March 7th when many Night Herons had apparently departed there were still numbers of fresh eggs to be found.

Ferguson's collectors found the Night Heron fairly common at Perambulam in North Travancore and at other places round the Vembanad Lake. Otherwise I find no records from the west beyond Willam Davison's statement that he heard its call on several occasions in the Wynaad.

Gorsakius melanolophus melanolophus (Raffles).

Ardea melanolopha Raffles, Trans. Linn. Soc., vol. xiii, pt. 2 (November 1822), p. 326—Sumatra.

In the Presidency the Malay Bittern is confined to the western side and even here we do not know very much about it. There is a specimen from Coorg (Day) in the British Museum. Col. H. R. Baker shot a fine female on 31 October 1921 in a shola on the top of the Sigur Ghat 7,200 ft. near Ootacamund where it appeared to be a straggler (*J.B.N.H.S.*, xxviii, 547). This specimen is now in my own collection.

In Travancore it appears to be a resident. Bourdillon obtained a male at Invercauld 2,500 ft. on January 3rd 1878 which is now in the British Museum. Ferguson received two examples alive and Stewart is said to have obtained many nests (*Nidification*, iv, 479). He found the breeding season to be from the end of May to early July.

Ixobrychus sinensis sinensis (Gmelin).

Ardea sinensis Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 642—China.

According to Stuart Baker the Yellow Bittern is common and resident in Travancore and Malabar but the only original record that I can trace for this area is that by Ferguson whose collectors brought 'several specimens from North Travancore where it was found solitary on the banks of the backwaters about Kottayam and Vycome'. Two males and a female from Trivandrum (February) are in the British Museum as well as another specimen marked Madras, February, A. G. Theobald.

Ixobrychus cinnamomeus (Gmelin).

Ardea cinnamomea Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 643—China.

There are two specimens of the Chestnut Bittern from Coorg in the Tweeddale collection in the British Museum. Hume received two other specimens from the Wynaad (*S.F.*, x, 417). Jerdon (*Madras Journ. Lit. Sci.*, No.29, October 1840, p. 198) tells us that he saw it on the banks of the Pykara river in the Nilgiris. In Travancore, according to Ferguson, it is common on all the lakes and backwaters.

For the eastern side of the Presidency I have no information beyond the fact that Dr. Gravely kindly informs me that there is a local specimen in the Madras Museum.

There is nothing to shew the status of the Chestnut Bittern in the Presidency.

Dupetor flavicollis flavicollis (Latham).

Ardea flavicollis Latham, Ind. Orn., vol. ii (1790), p. 701—Oude, India.

The Black Bittern must be very generally distributed, I presume as a resident, throughout the western side of the Presidency, as in addition to Jerdon's somewhat vague statement that he had seen it on the Malabar coast in rice fields, there are several records. A specimen from Calicut is in the Hume collection. Mr. Betts informs me that he came upon one in Coorg, almost treading on it as he climbed a log in a stream bed in a dark wooded ravine. William Davison says that he had seen it in the Wynaad and that he had also seen a specimen killed by a native shikari close to Ootacamund.

Fairbank stumbled on a sepcimen below Vilparti in the Palnis in 1867 under much the same circumstances as Betts. There is an Anjango skin in the British Museum and Ferguson considered it not uncommon along the backwaters in Travancore, frequenting the more thickly covered canals.

On the eastern side it is only reported from the neighbourhood of Madras near which place Jerdon saw it. There is a local specimen in the Madras Museum.

Botaurus stellaris (Linnaeus).

Ardea stellaris Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 144—Sweden.

The Bittern is an occasional straggler to the Presidency. There may perhaps be some doubt about Jerdon's statement (*Madras Journ. Lit. Sci.*, No. 29 (1840), p. 198) that he had seen a specimen shot in the Nilgiris in the hot season and it is to be noted that he does not repeat it in the *Birds of India*.

There is, however, no doubt about the specimens recorded by Rhenius (*J.B.N.H.S.*, xvii, 247) near Cuddalore, about 120 miles south of Madras and by Captain C. B. Harrison, I.M.S., from near Madura (*J.B.N.H.S.*, xvii, 1037). Both were obtained about 1907 but exact dates are not given.

Phoenicopterus ruber roseus Pallas.

Phœnicopterus roseus Pallas, Zoogr. Rosso-asiat., vol. ii (1827), p. 207—Mouth of the R. Volga, Caspian Sea, South Russia.[1]

Jerdon tells us that he saw the Flamingo in the greatest abundance at the Chilka Lake where many hundreds were gathered together. It is still said to be found there, though less frequently and in smaller numbers than formerly as the lake is now more accessible to sportsmen than in former days (Stuart Baker, *Game Birds*, i, p. 4). Jerdon also says that the bird is very abundant in the Pulicat Lake near Madras (where Dewar says they are to be found every cold weather, he himself having seen over a thousand there), between Madras and Pondicherry and still further south towards Tuticorin. Throughout this last district W. N. Fleming writing in 1892 (*J.B.N.H.S.*, xii, p. 216) says the Flamingo is fairly common. One large flock, he continues, of quite 300 frequented a shallow piece of water, about three miles from Tuticorin, all the cold weather and remained until the end of April when the water dried up. It was however still in the neighbourhood in July.

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[1] For the use of this name see Grant and Mackworth-Praed, *Bull. B.O.C.*, vol. liv (1933), pp. 16-17.

Major Phythian Adams (*B. of S. India*, p. 465) says that he met with a flock of many hundreds near Dhanushkodi at the end of March or beginning of April 1922. They were on the lagoon beside the railway line.

There is no reason to believe that the Flamingo breeds in the Presidency and there is no information on record regarding their arrivals or departure beyond a very interesting note by S. C. Law (*J.B.N.H.S.*, xxx, 226). In 1924 Mr. Law was at Vizagapatam and on 19 August he saw about 150 Flamingoes flying past out at sea, about a mile from the coast, at 12-30 midday. They were travelling very low over the sea and flying from due north to south. Next day a similar flock was following the same line at the same time and on 24 August a still larger flock was noted about 3 miles out at sea at 7-30 a.m., also flying south and quite high in the air.

Sarkidiornis melanotos Pennant.

Anser melanotos Pennant, Ind. Zoology (1769), p. 12, pl. xi—Ceylon.

The Nukta or Comb-Duck appears to be rare in the Presidency and there is very little on record about it. Hume says (*S.F.*, x, 417) that he believes it occurs in the Wynaad. Theobald is quoted (apud Hume and Marshall, ii, 91) to the effect that south of Mysore he had only seen it in the Collegal Taluq of Coimbatore and not to the best of his belief further south. He adds that it comes about December and leaves again in February and March but is very rare, only 4 or 5 pairs coming each year. Mr. Hatchell records it from the Sripuram Tank near Podanur (*Birds of S. India*, p. 467).

On the eastern side the only information is furnished by two specimens in the Madras Museum supposed to have been collected at Madras and Chingleput and the fact that Mr. R. F. Stoney kindly informs me that he shot 4 Comb-Duck in the Godavery district in the season of 1928-29.

There are two specimens labelled 'Madras' in the British Museum.

Rhodonessa caryophyllacea (Latham).

Anas caryophyllacea Latham, Index Orn., vol. ii (1790), p. 866—India.

All that is known about the former status of the Pink-headed Duck in the Presidency will be found in *Game Birds*, vol. iii, p. 175. Here Hume says :—It certainly occurs in the Pulicat Lake as I have a specimen shot there [this is presumably the immature specimen marked 'Madras' in the Hume collection], and Jerdon years previously had obtained a specimen in the Madras market caught there, and another from Nellore. Again north of Nellore it appears to occur in suitable situations in Vizagapatam and Ganjam. 'The locality Vizagapatam is expanded in the following footnote from Lt.-Col. W. J. Wilson.—"The Pink-headed Duck used to frequent a piece of water near Condakirla about 27 miles south of Vizagapatam and in all probability is still to be found there, as well as at similar places in the Northern Circars, although I do not now remember having actually seen it except at Condakirla . . . to the best of my recollection the Pink-headed Duck I shot were killed in November and December. I think I saw about 15 or 20 on each occasion of my visit." '

The Pink-headed Duck is now so dwindling in numbers that the chance of its occurring again in the Presidency is of the very slightest.

Nettapus coromandelianus coromandelianus (Gmelin).

Anas coromandeliana Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 522—Coromandel coast.

The Cotton-Teal seems to be fairly generally distributed in the Presidency but it is not found in large numbers and I find no notes that allow one to arrive at its status accurately. On the western side it is evidently rare. Major Phythian Adams who has shot at Cannanore for the seasons 1925-1926 to 1935-1936 only met with it there on two occasions, viz. 2 birds on 10 December 1930 and a party of 6 on 27 November 1933. Hume says it occurs in the Wynaad (*S. F.*, x, 417). Kinloch recorded (*J.B.N.H.S.*, xxvi, 674) 4 shot in the Nelliampathies. In Travancore Ferguson thought it was a winter visitor and never abundant at any time, In the rest of the Presidency I have records from Ganjam, Vizagapatam, Kistna, Madras, Chingleput, Salem, Tanjore, Coimbatore, Madura, Tinnevelly and Tuticorin. These are mostly supplied to me by Mr. R. F. Stoney whose *Game Book* shows a total of 72 Cotton-Teal shot in the years 1903-1931. At Tuticorin Mr. W. N. Fleming (*J.B.N.H.S.*, xii, 216) calls this little duck 'fairly common during the cold weather until the end of April' but more numerous at Tinnevelly.

An albinoid specimen from Madras is described by W. F. Dique (*S.F.*, ix, 508).

Anser indicus (Latham).

Anas indica Latham, Index Orn., vol. ii (1790), p. 839—India.

A winter visitor. In Hume's day the Bar-headed Goose was extremely abundant at the Chilka Lake (*Game Birds*, iii, 82) and according to Annandale (*Records Ind. Mus.*, xxii, 329) it is still found there and remains as late as the beginning of April. Mr. R. F. Rainey informs me that he shot 4 in the Kistna district in the season 1905-1906. Mr. Hatchell records it from near Nellore and Cuddapah, and geese, which are probably of this species, are reported to frequent the sea coast as far south as Pamban Island (*Birds of S. India*, p. 471).

Mr. Albert Theobald (apud *Game Birds*, iii, 82) says 'I have not seen this Goose south of Coimbatore. I have shot them in the Collegal Taluq only; they come at the end of November or early in December and leave about February or March—a few stragglers being found in April in the Agaroram tank about 3 miles from Collegal. They are far from common, only a few, ten to twenty, being found in a flock.'

W. N. Fleming, however, says it is a regular cold weather visitor to Tuticorin (*J.B.N.H.S.*, xii, 216) and he remarks on the considerable but unusual numbers that arrived in the cold weather of 1897-98 and were there from November until the end of February. He saw one flock containing about 50 birds and 5 birds were brought to him in one day by a 'pot hunter'.

Finally it is necessary to recall—but not to attach too much importance to—Jerdon's oft quoted statement that he once saw a pair in August in a small sequestered tank within a few miles of Cape Comorin.

Dendrocygna javanica (Horsfield).

Anas javanica Horsfield, Trans. Linn. Soc., vol. iii, pt. i (May 1821). p. 199—Java.

My information about the Whistling Teal is far from complete and its status is not clear. Large flocks occur on the Chilka Lake but according to Annandale (*Records Ind. Mus.*, xxii, 330) they appear to leave as soon as the rains set in and are not seen between the end of June and November. Mr. Rainey has shot it in the Ganjam and Kistna districts and also down in Madura, and Dewar includes it without comment in his Madras list. In Tuticorin W. N. Fleming (*Journ. B.*, xii, 216) calls it rarer than the Cotton-Teal but apparently pretty plentiful in December, January and February.

On the western side Hume (*S.F.*, x, 417) says he has seen it from the Wynaad. Phythian Adams informs me that he has met it in Cannanore in December. Ferguson says that it is common on all weedy tanks throughout Travancore but perhaps commoner in the north than in the south. On one piece of fresh water near Sastancottah he saw hundreds in April 1902 though there was not a single bird in the same place in December 1903. It is probably to this species which Mr. Sherman refers (apud Hume and Marshall, iii, 119) where he says that it is generally seen in N. Travancore only from October to April but that some must stay and breed as he has seen young in August.

[**Dendrocygna fulva** (Gmelin).

Anas fulva Gmelin, Syst. Nat., vol. i (1839), p. 530—Nova Hispania.

Jerdon is said to have obtained the Large Whistling Teal occasionally near Nellore but details are lacking and there appears to be no authentic information about the occurrence of this species in the Presidency. Annandale does however, record a pair on the Chilka Lake as frequenting Barkuda Island during the rainy season of 1919 (*Records Ind. Mus.*, xxii, 330).]

Casarca ferruginea (Vroeg).

Anas ferruginea Pallas in Vroeg, Cat. d'Ois. Adumb. (1764), p. 5—Tartary.[1]

Sherborn remarks re the type loc. of *ferruginea* as follows :—No locality cited 'Tartarysche Gans. *Anser Tataricus ferrugineus Mas'* in catalogue.

The Ruddy Sheldrake or Brahminy Duck is a winter visitor to the Presidency in small numbers. It is fairly common on the Chilka Lake (Stuart Baker, *Game Birds,* i, 140, Annandale, *Records Ind. Mus.*, xxii, 330) while Mr. R. F. Stoney kindly informs me that in the Kistna district he shot one in the season 1905-1906 and three more in the season 1923-1924.

On the western side Major Phythian Adams informs me that he killed a bird from the only pair he has ever seen at Cannanore on 15 November 1935.

Theobald (apud Hume and Marshall, iii, 123) says that he had shot them in the Salem, Tinnevelly and Coimbatore districts. They come in about November and leave about March. They are not common, seldom more than 3 or 4 in a batch. In 1869 he shot one in the Collegal Taluq as late as June, but this must surely have been a pricked bird.

Anas poecilorhyncha poecilorhyncha Forster.

Anas poecilorhincha Forster, Indische Zoologie (1781), p. 42, pl. xii, fig. 1—Ceylon.

The status of the Spot-bill in the Presidency is not very clear. A few pairs were noted on the Chilka Lake in April and June 1920 by Annandale (*Records Ind. Mus.,* xxii, 330). Mr. R. F. Stoney informs me that he has shot it in the Vizagapatam, Kistna, Kurnool and Tanjore districts, the total for the seasons 1904-1905 to 1930-1931 coming to 25 head. Dewar includes it without comment in his Madras list.

At Tuticorin W. N. Fleming (*J.B.N.H.S.*, xii, 216) says that it occurs in small numbers but apparently arrives after the cold weather as he saw none until March while 2 were brought to him by a shikari on 12 July.

Chaulelasmus streperus (Linnaeus).

Anas strepera Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 125—Sweden.

The Gadwall is a winter visitor in small numbers to the north-east of the Presidency and Mr. R. F. Stoney has kindly sent me details of nine individuals he has shot in the Vizagapatam and Kistna districts in the seasons 1903-1904 to 1930-1931. Dewar includes it in his Madras list without comment but it must be remembered that his list of ducks was made from the specimens in the local Museum and it is not quite certain where all of these came from.

On the western side Hume (*S.F.*, x, 418) was almost sure that it had been reported to him from the Wynaad.

Mareca penelope (Linnaeus).

Anas penelope Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 126—Sweden.

The Wigeon is a winter visitor to the Presidency but it is evidently neither general nor common as Mr. R. F. Stoney in the details of his bags for the seasons 1903-1904 to 1930-1931 can only tell me of two that he has shot, one in Kistna district, season 1923-1924, and the other in Vizagapatam district 1928-1929.

In Tuticorin Fleming considered them fairly common though their stay was short. It will be remembered, however, that this is one of the ducks whose numbers in India vary a great deal from year to year.

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[1] There is no copy of Vroeg Cat. d'Ois. in the British Museum but Sherborn made a facsimile copy some years ago which was published in *Smithsonian Misc. Bull,* 47, pp. 332-347.

Nettion crecca crecca (Linnaeus).

Anas crecca Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 126—Sweden.

The Common Teal is a winter visitor to the Presidency and it is no doubt common and widely spread though I cannot trace much information about it. On the eastern side Mr. R. F. Stoney informs me that he has shot it in the districts of Ganjam, Kistna, Chingleput, Tanjore and Madura though his *Game Book* only records a total of 27 for the seasons 1903-1904 to 1930-1931. Theobald (apud Hume and Marshall, iii, 207) records Teal at Tinnevelly as being found in great abundance in the large tanks south of Palamcottah and Fleming (*J.B.N.H.S.*, xii, 216) calls them plentiful throughout Tuticorin district.

On the Malabar coast the Teal seems to be virtually unknown but Ferguson says he obtained a single specimen in South Travancore. On the Nilgiris William Davison says that small parties occasionally drop into the lake at Ootacamund but are not permitted to stay there long.

According to Theobald this duck usually arrives in South India at the beginning of the north-east monsoon about November and leaves again in March and April while he shot some in the Tinnevelly district as late as 15 May.

Dique (*S.F.*, ix, 508) remarks that he has heard of an albino Teal, obtained presumably at Madras.

Dafila acuta (Linnaeus).

Anas acuta Linnaeus, Syst. Nat., ed x, vol. i (1758), p. 126—Sweden.

The Pintail is a winter visitor to the Presidency but I have very little information about it. In the seasons 1903-1904 to 1930-1931 covered by his *Game Book* Mr. R. F. Stoney informs me that he has killed a total of 7 birds in the Kistna and Tanjore districts and Dewar includes the species in his Madras list without comment.

At Tuticorin Fleming (*J.B.N.H.S.*, xii, 216) says the Pintail is by far the commonest duck, remaining from November to March in large flocks of 200 to 300 birds.

On the Malabar coast it is rare or wanting, but Hume says it occurs in the Wynaad though reported rare there.

Querquedula querquedula (Linnaeus).

Anas querquedula Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 126—Sweden.

The Garganey is evidently the most numerous species of Duck which is found in the Presidency and the fact that Mr. R. F. Stoney's *Game Book* gives a total of 144 shot in the seasons 1903-1904 to 1929-1930 furnishes an idea of its numbers compared with other species. It occurs apparently on every suitable piece of water from the Chilka Lake to Cape Comorin but its principal headquarters in the winter seem to be the backwaters of Travancore where very large flocks are to be found.

Theobald (apud Hume and Marshall, ii, p. 216) says that the Garganey arrives in Southern India (i.e. south of Mysore) about the early part of December and leaves by March or April, a few stragglers remaining till May or June and this agrees roughly with what Fleming says at Tuticorin (*J.B.N.H.S.*, xii, 216). Major Phythian Adams however says (*Birds of S. India*, p. 479) that he has found a party at Cannanore as early as 24 September 1927.

Spatula clypeata (Linnaeus).

Anas clypeata Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 124—South Sweden.

The Shoveller is not a very common winter visitor to the Presidency. Mr. Stoney's *Game Book* for the seasons 1903-1904 to 1930-1931 shows a total of 13 birds shot in the Ganjam and Kistna districts and specimens in the Madras Museum are said to have been procured at Madras and Chingleput.

On the western side Hume says (*S.F.*, x, 417) that he has received a specimen from the Wynaad.

Netta rufina (Pallas).

Anas rufina Pallas, Reise Russ. Reichs., vol. ii (1773), p. 715—Caspian Sea.

Mr. Stoney informs me that he killed 12 Red-crested Pochards in the Vizagapatam district in the season of 1928-1929. There are two specimens in the Madras Museum labelled Madras and Arkonam but I can find no other record for the Presidency.

Nyroca ferina ferina (Linnaeus).

Anas ferina Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 126—Sweden.

The Pochard is a scarce winter visitor to the Presidency. Mr. Stoney informs me that he shot two in the Vizagapatam district in the season 1928-1929 and one was killed at Bellary on 6 December by Colonel McMaster (Hume and Marshall, iii, 247).

[**Nyroca rufa rufa** (Linnaeus).

Anas rufa Linnaeus, Fauna Suec. ed. ii (1761), p. 47—Sweden.

There is no definite record of the White-eyed Pochard in the Presidency beyond Hume's general statement (*Game Birds*, iii, 263) that it occurs in the Northern Circars and that he has no record from south of Madras.]

[**Nyroca marila** (Linnaeus).

Ans marila Linnaeus, Faunna Suecica, ed. ii (1761), p. 39—Lapland.

I find difficulty in accepting the correctness of Colonel McMaster's idea that 'one year, in January, he saw several birds of this species, on marshes and salt lakes between Chicacole and Berhampore in the Northern Circars (say 19° N. Lat.)' (Hume and Marshall, iii, 271).]

Nyroca fuligula fuligula (Linnaeus).

Anas fuligula Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 128—Sweden.

Theobald (Hume and Marshall, iii, 278) says that he met this duck in the northern part of Coimbatore. Otherwise the only information that I have of it in the Presidency is furnished by the 11 birds in Mr. R. F. Stoney's records, shot in the seasons from 1903-1904 to 1930-1931 in the Vizagapatam, Godavery, Kistna, Chingleput and Chittoor districts. Hume says that it has been shot near Bellary.

Podiceps ruficollis capensis Salvadori.

Podiceps capensis Salvadori, Ann. Mus. Civ. Gen. (2), vol. i (1884), p. 262—Shoa, East Africa.

William Davison tells us that he had found the Little Grebe in several places in the Wynaad and that it is a permanent resident on the lake at Ootacamund where it breeds in large numbers in May and early June (*N. & E.*, iii, 404)—Cardew adds early August. As Jerdon points out this lake is artificial in origin and migrating birds must travel at a considerable height to have found and colonised it. Fairbank says that it is also resident on the lake at Kodaikanal in the Palnis, where Terry later found it. In Travancore it is also resident, according to Ferguson, and breeds in August.

On the eastern side the only information that I can find about it, beyond Davison's inclusion of the bird in his Madras list is the fact that A. G. R. Theobald found a nest on 19 August on a lake near Ahtoor in the Shevaroys (*N. & E.*, iii, 404).

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(*THE END*).

THE SNAKES OF DEOLALI.

WITH NOTES ON THEIR COMPARATIVE OSTEOLOGY AND PECULIARITIES OF DENTITION.

BY

A. G. L. FRASER, I.M.D.

PART III.

(*With 4 plates*).

(*Continued from page 290 of this volume*).

SUB-ORDER: OPHIDIA

FAMILY: TYPHLOPIDAE

Species: **Typhlops braminus** (Daud.). The Worm Snake. There appears to be no local name for it.

Exoskeleton.—The body is uniformly rounded throughout, without showing any distinction between the head, body and tail. There is a covering of cycloid scales, which give it the semblance of a worm. The distinction of the ventral shields is purely arbitrary, as they are not enlarged. The anal shield is not differentiated. The costal scales average 20 in the count. The snout is rounded. The tail is abbreviated and terminally spined.

Colour.—This snake dorsally shows varying shades of brown. The brown colour tone is lighter anteriorly and ventrally; in the anal region the colour is white.

Length.—The smallest measured 3 in. and the largest 7 in.

Eye.—This is comparatively distinct and the pupil is spherical.

Endoskeleton.—Skull. There is a heavy bone formation anteriorly. There are no squamosals and no ectopterygoid bones. The pterygoid is cartilaginous and does not touch the mandible. The maxilla is transversely placed and equipped with one tooth. The praefrontal shows a suture with the nasals. The mandible is toothless and the coronoid bone is present. The vomer and turbinals are heavily formed and convexed on the ventral aspect. Immediately behind the eye is a depression or sulcus for the reception of the poison gland.

Vertebrae.—There are no neural spines and the hypapophysis is absent throughout the vertebral column. The caudal section is very short and terminates abruptly. The cloacal vertebrae show a rudimentary pelvis.

Glandular structures.—In the sulcus immediately behind the eye and above the temporalis anterior muscle is a small gland.

Locomotion.—The zigzag spiral motion is not exaggerated and is the same as the movement noted for *Lycodon aulicus.*

Habitat.—Peninsular India, Burma, Ceylon, Mexico, South of the equator in Africa, Arabia to S. China and coastal islands (Wall).[1]

Note:—Appears chiefly during the rains in Deolali. A young specimen 3 in. long was secured in a garden during October. An adult was found swimming in a receptacle of water. Another was retrieved from the mouth of a dog. In this case the snake's back was found broken.

This is a typically burrowing snake.

FAMILY: BOIDÆ.

SUB-FAMILY: PYTHONINAE

Species: **Python molurus** (Linn.). The Python or Rock Snake.

Local name.—'Azgar'.

Exoskeleton.—This snake presents a massive formation. The snout is long. The head is flattened dorso-ventrally and is posteriorly broad. The jaws are heavy and the musculature well developed. The neck is distinct. Anteriorly the body is comparatively slender; the rest of the body is massively built and heavy. The tail is short, thick, strongly formed, and terminates abruptly.

The scales are smooth, juxtaposed and as broad as long. In the two specimens secured the costal scales numbered 63 and 72 respectively. The ventrals numbered 244 and 250 and stretched across the belly. The anal shield was entire. Near to the cloacal aperture, one on either side were excrescences of a horny nature resembling claws. These are said to be vestigial hind limbs.

Colour.—The head showed black markings. A linear brown streak crossed the eye and another ran below it. Dorsally there were reddish brown spots edged with black. A smaller series of similar spots ran laterally on either side laid on a background of yellowish brown. The belly was white.

Eye.—Small. The pupils vertical.

Endoskeleton.—The osteology and dentition of this species was not studied. As regards the dentition, the only peculiar feature obtaining with the python is that the praemaxilla is dentigerous.

The gland structures were not investigated.

Locomotion.—This is by movement in the straight axis of the body.

Habitat.—Ceylon; Peninsular India, to the extreme limit of Sind; Himalayas—Dehra Dun to Sikkim; Assam, Burma, Siam, S. China and the coastal islands, Malay Peninsula and Archipelago, Java (Wall).

Note:—Secured during daylight in outlying quarries beyond the rifle range in the cold weather months.

Length.—5 ft. 6 in. and 6 ft. 2 in. Sex not ascertained.

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[1] The distribution shown is that quoted in the paper 'The Snakes of Bombay Island and Salsette' by S. H. Prater, C.M.Z.S. (April 1926): taken from Col. Wall's 'Hand list of Snakes'. This information will be repeated for all the species.

SUB-FAMILY: BOINAE.

Species: **Eryx conicus** (Schn.). The Earth Boa (red).

Local name.—The local inhabitants regard this snake as the young of the Python and because of the colour resemblance call it 'Azgar'.

Exoskeleton.—The snout is pointed. The head is anteriorly narrow and posteriorly broad. It is comparatively small for the size of the body. The neck division is distinct. The anterior third of the body is narrower than the middle and posterior third, which is stoutly and broadly built. The tail is thick, short and blunted. It is roughly 1/10th of the body length.

The epidermis consists of juxtaposed nodular scales, which are as broad as long and dorsally keeled. The keeling is more marked over the caudal area. On the head the rostral and internasal shields are well defined. The supralabials number 13. The costal scales number 37 to 42 in the anterior third, 45 to 49 in the middle third and 29 to 35 in the posterior third of the body. The ventral plates number from 174 to 180. These are slightly enlarged and do not extend across the belly, being actually half the width. The anal shield is divided into three sections. The subcaudals are entire throughout and number from 18 to 21.

Length.—The smallest in the series measured 9 in. and the largest 2 ft. 3 in.

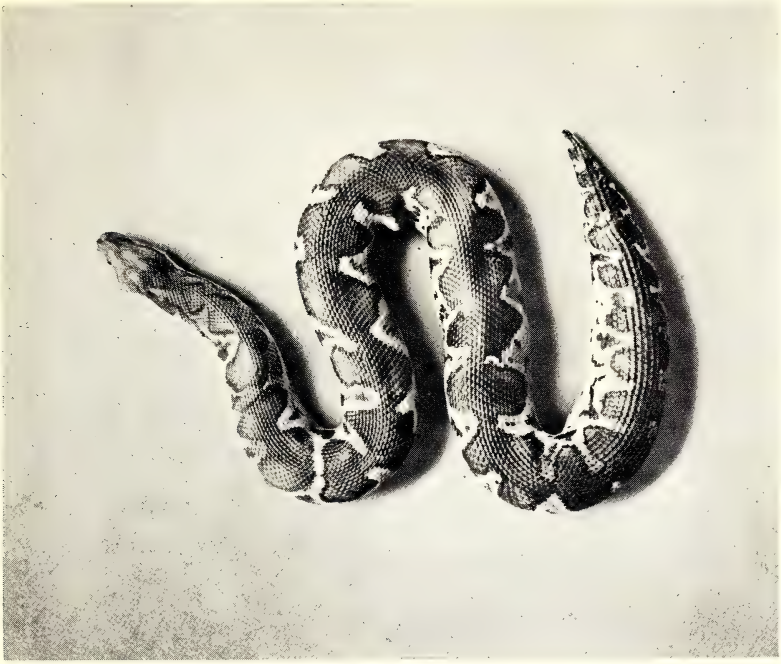
Colour.—A series of irregular dark brown or reddish brown patches edged with black, placed on a background of buff or wheat. The belly in the adult is white. In the young the colour tones are lighter and the belly is pink.

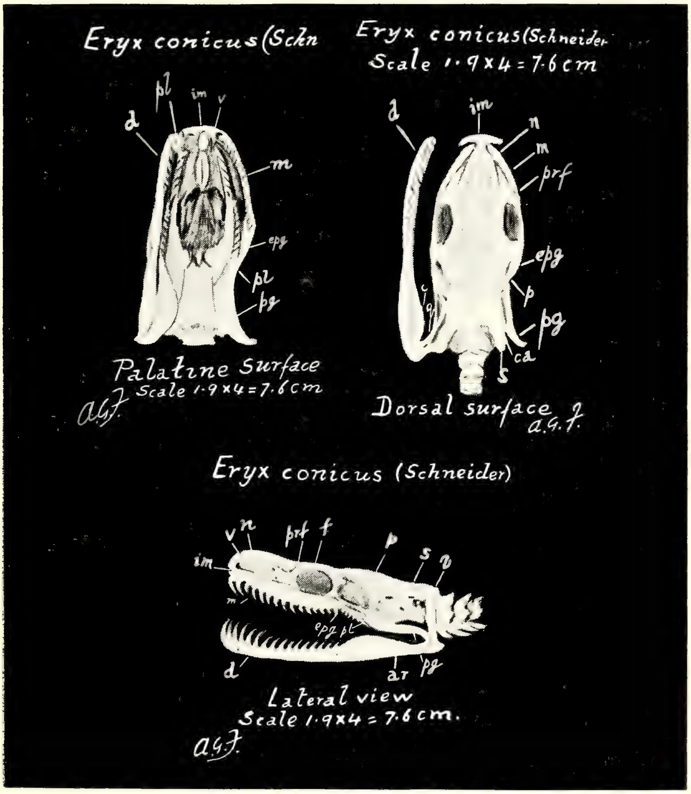
Eye.—This is small and the pupil is vertical.

Endoskeleton.—Skull. In the young the anterior part of the skull for two-thirds of its length is slightly oval. In the adult it presents a triangular shape. The posterior half is constricted in the mastoid region. The intermaxillary is well defined and overlaps the maxillary bone. The maxillaries are broad and long. A suture divides the frontals and nasals. The praefrontals are small. The parietals are ridged centrally in the long axis. Behind the postfrontal zygoma is a depression for the lodgement of the poison gland. The quadrate is a rod-like bone. The pterygoid is posteriorly broad, ventrally grooved and touches the mandible. The ectopterygoid is small. The articular end of the mandible is broadly formed. The palatine bones are small.

Dentition.—There are no grooved fangs. All the teeth are solid and recurved. The maxillary teeth number in the young 12, and in the adult 16; the anterior are the largest and the posterior diminish in size. The palatine teeth number 5 on either side; the anterior ones are large. The pterygoid teeth number in the young 7, and in the adult 12; they are all small and of equal size. The dentary part of the mandible is provided with 16 teeth; the anterior are very large.

Vertebrae.—The neural spines are rudimentary and show tubercles on the posterior neural arches. In the caudal vertebrae the neural spines present the normal squared plate-like extensions seen

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The Red Earth Boa (*Eryx conicus*).
(*For explanation of lettering on plates, see end of article.*)

in the species in which the spines are small. The hypapophysis is well developed in the cervical vertebrae and in the thoracic series gradually diminishes in size. It is absent in the dorsal vertebrae.

Ribs.—The ends are bulbous. They are small in length in the cervical and part of the thoracic sections and increase in length from thence until the maximum size is attained about the middle third of the body. There is a corresponding decrease up to the cloacal vertebrae, where are featured two rib processes fused with the vertebrae. In the caudal vertebrae there is a single rib process similarly ankylosed to the body of the vertebra.

Locomotion.—A slow-moving snake—the spirals in the zigzag motion are much exaggerated, even more so than in the Russell's Viper.

Glandular structures.—In the depression behind the post-frontal zygoma and above the temporal muscle, immediately behind the eye is a small gland. The closely related *Eryx jaculus* (Linn.), has a similar gland. Col. Gharpurey[1] (Nov. 1932), Case 7, reported the case of a woman, who was bitten by an *Eryx conicus* without ill effects.

Habitat.—Peninsular India: South of the Himalayas, Ceylon.

Note:—This snake is aggressive. It will snap with a startling suddenness on the least provocation. If touched it displays resentment by leaping in the air about half an inch off the ground with the body in a rigid contracted state. It then slithers along the ground in a series of short, sharp, jerky side to side leaps, maintaining the rigidity in its body. If left alone it will move normally. It is burrowing in its habits. The tail is prehensile and functions as a constricting finger securing a firm hold on any object, be it a stone or stick. Our specimens were encountered during daylight in the mornings.

FAMILY: COLUBRIDÆ.

SUB-FAMILY: COLUBRINAE (*Aglypha*)

Species: **Nerodia piscator** (Schn.). The Checquered Water Snake.

Local name.—Pani-ki-samp.

Exoskeleton.—The snout is pointed. The head is oblong and narrow. The neck is slightly demarcated. The anterior or cervical portion of the body is thinner. The body is dorsally ridged and laterally compressed and the maximum thickness is attained in the middle third. The tail is round and tapering. The scale formation shows head shields and large imbricated scales on the body. The costal scales are dorsally distinctly keeled, especially in the middle third. Laterally the keeling is less marked. The supralabials are 9 in number—the first and second touch the nasal shield, the fourth and fifth touch the eye, the seventh and eighth touch the temporal shields. There is only one loreal. The praeoculars number 2 and the postoculars 3. The costal scales average 19, 17 or 19, 17, in the anterior, middle and posterior third of the body, respectively. The ventrals number from 141 to 148. The anal shield is divided into two sections. The subcaudals are divided throughout and number from 77 to 89.

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[1] 'Snakes in Ahmednagar' by Lt.-Col. K. G. Gharpurey, I.M.S., *Journ. Bom. Nat. Hist. Soc.*, vol. xxxvi, No. 1, p. 272, 15-11-1932.

The naris is placed superiorly.

Length.—The smallest measured 8 in. and the largest 3 ft. 8 in.

Colour.—Sepia tones on the head. The costal margin is yellowish green. Dorsally there are irregular black and orange mottlings on a background of dark green. Each scale in fact is edged with black or orange. The belly is pale yellow anteriorly, buff coloured in the middle third and faintly pink under the tail. The iris is yellow and the pupil is spherical.

Endoskeleton.—Skull. The anterior part of the skull is broader than the posterior half. The intermaxillary overrides the maxilla. The nasal is specifically small and the division between it and the maxilla and praefrontal is bridged over by cartilaginous strips. The maxillary bones are thin and long. The praefrontals are suturally united with the frontals but do not touch the nasals. The ectopterygoid is thin and medium-sized; its maxillary articular end is a squared plate with the inner anterior angle projected forward in the shape of a finger extension. The squamosals are broad, flat and long. The quadrate is superiorly broadly spatulate and grooved. The articular end of the mandible is broadly formed. The pterygoid is posteriorly broad and ventrally grooved and touches the mandible.

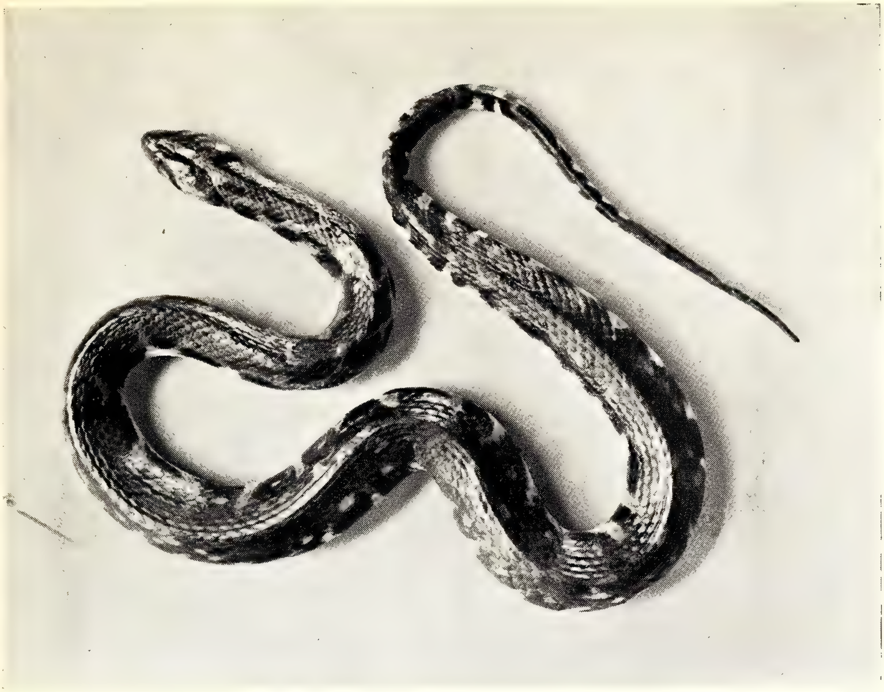
Dentition.—The maxillary teeth number 17; the posterior ones are the larger. The palatine teeth number 8; the anterior are larger. The pterygoid teeth number 22; they are all small and of equal size. The dentary is provided with 24 teeth; the anterior and middle series are the largest. On the outer or maxillary side of the palatine and pterygoid bones, below the operative teeth in use, is a double row of reserve teeth imbedded in the wall of the bones. Similarly the maxillary bones on their inner aspect are provided with a double row of reserve teeth.

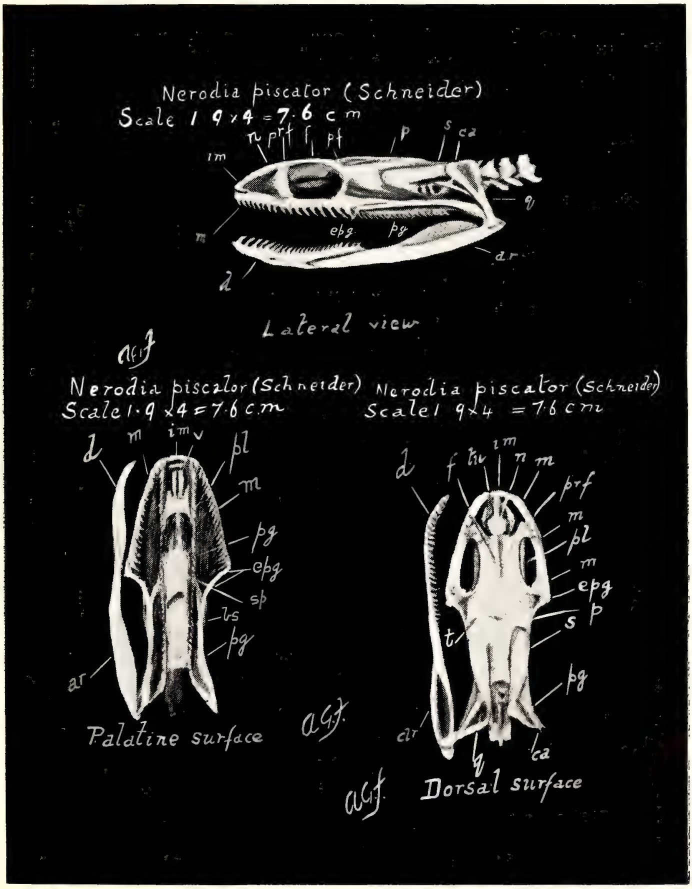
Vertebrae.—The neural spines are well developed in the form of squared plate-like extensions. The hypapophysis is present in a uniform and pronounced character throughout the cervical, thoracic and dorsal vertebrae.

Ribs.—The free ends are blunted and slightly bulbous. They are longest in the middle third of the body, and the anterior and posterior third parts of the body show the ribs gradually diminishing in length. The cloacal and caudal vertebrae show the double and single processes fused with the body of the vertebra. This is a feature with all snakes and need not be repeated in the descriptions of the other species to follow.

Locomotion.—The movement, both in the act of swimming in water and the motion on land, in as far as the spiral action is involved, appears identical. It is the same as that seen in *Lycodon aulicus*.

Gland structure.—This snake is provided with a large parotid gland. The toxicity of its secretion was observed by Alcock and

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Dorsal surface

The Checquered Water Snake (*Nerodia piscator*).

Rogers in 1901. Mme Phisalix and Caius (1916) have confirmed this. Its venom kills birds, lizards, frogs and small mammals. Its bite would not seriously harm man or the larger animals.

Habitat.—Peninsular India, Ceylon, Burma, Andamans, Malay Peninsula and Archipelago, Siam, Indo-China, China, Formosa (Wall).

Note:—The majority were secured by day on the banks of the river 'Darna' and in its tributary streams. There were two gravid females in which eggs were found—in one 26 and in the other 16 in a state of early development.

Species: **Rhabdophis stolatus** *Tropidonotus stolatus* (Linn.). The Buff-striped Keelback. There appears to be no local name for this snake.

Exoskeleton.—The form is proportionately slender. The snout is obtusely rounded. The head is ovate and dorsally convexed. The body for two-thirds of its length is of a uniform thickness. The neck is well defined and the tail is long and tapering. The naris is laterally placed.

Scale formation.—There are large head shields present. The costal scales are longer than broad, imbricated and heavily keeled throughout. The supralabials number 8; the first of these touches the nasals; the third, fourth and fifth touch the eye, and the sixth and seventh the temporals. As in the case of all Colubridae the sublinguals are in two pairs. There are 1 praeocular and 3 postoculars. There is one loreal. The ventrals number from 150 to 153 and stretch completely across the belly. The anal shield is divided into two sections. The subcaudals number from 75 to 87 and are divided throughout. The costal scales number 19, 19, 19-17, in the anterior, middle and posterior third of the body respectively.

Colour.—The head is a very dark brown and the parietal shields are stippled with yellow. The supralabials are orange tinted. The infralabials and the under surface of the neck are tinged yellow. On either side from the neck backwards in the long axis are two buff-coloured stripes laid on a background of sepia. There are black striations stippled with creamy yellow spots transversely placed at intervals. These striations do not involve the buff stripes flanking the body and they are more conspicuous anteriorly and fade towards the tail. Dorsally over the tail the colour is brownish yellow. The ventrals in the anterior half are spotted black. The belly is pale yellow. The young specimens show fresher colour tones. Spirit specimens kept for long periods change to a slate colour.

The length was:—The largest 21½ in. and the smallest 11 in.

Eye.—This is large. The iris is golden and the pupil spherical. The nares are laterally placed.

Endoskeleton.—Skull. This is ovate in formation. The intermaxillary is wedged in between the maxillary bones. The nasal bones are small. The praefrontals are suturally united with the frontals and the division between them and the nasals is covered over with a cartilaginous septum. The temporal bones laterally bulge. The parietals posteriorly terminate in three bony spicules placed over the supraoccipital. The squamosals are flat, narrow and of medium length. The quadrate is superiorly spatulate and short. The articular end of the mandible is broadly formed but the dentary portion is slender and long. The maxillary bones are long and thin. The pterygoids are narrow and are not ventrally grooved. They touch the mandibles. The ectopterygoid is thin and small. The palatines are of medium size.

Dentition.—All the teeth are solid, recurved, and comparatively small. None are grooved or perforated. The maxillary teeth number 19; the posterior two are large and set apart. The palatine teeth number 9 and are of uniform size. The pterygoids are set with 12 teeth of small size and of equal length. The dentary is provided with 22 teeth, of which the anterior ones are the larger. Only the maxillary bones appear to be provided with a row of reserve teeth.

Vertebrae.—The neural spines are small and plate-like squares. The hypapophysis is of nearly uniform size throughout the cervical, thoracic, and dorsal vertebrae.

Ribs.—The free ends are pointed. They are short in the cervical section and of uniform length for the greater portion of the body, diminishing in size towards the cloacal region.

Gland structure.—This snake is provided with a parotid gland. The experiments of Mme Phisalix and Caius have established the toxic character of the secretion to small animals, birds, rodents, lizards (1917).

Locomotion.—This has not been personally observed.

Habitat.—Peninsular India including the Himalayas up to 5,000 ft., Burma, Ceylon, Andamans and Nicobars, Malay Peninsula, Siam, China, Formosa, Philippines (Wall).

Note:—Appears during the rains. It is an uncommon species in Deolali. It æstivates during the hot weather.

Species: **Polyodontophis subpunctatus** (Dum. and Bibr.) Jerdon's Polyodont.

Local name.—None.

It is a rare snake in Deolali. Only one specimen was secured.

Exoskeleton.—Shows a slender formation throughout and a uniform roundness. The head is small and there is no distinction between it and the neck. The tail is round and of medium tapering length.

Scale formation.—There are head shields present. The body scales are imbricated and as long as broad. There is no keeling in evidence. The supralabials number 9, of which the first and second touch the nasals; the fourth, fifth and sixth touch the eye and the seventh and eighth the temporal shields. The costal scales number 17, 17, 17, in the anterior, middle and posterior third of the body respectively. The ventral shields number 198 and stretch completely across the belly. The anal shield is divided into 2 sections. The subcaudals number 68 and are divided throughout.

Length.—16 in.

Eye.—Small and the pupil spherical.

Colour.—The head was black anteriorly. The praefrontal shield and the supralabials were edged with pale yellow. A yellow streak carried backwards from behind the eye ended below the parietal shields in a broad yellow band. The nape of the neck was black with posteriorly a yellow frill. The anterior half of the body showed up a pinkish brown, while the posterior was a light brown. Every alternate scale and sometimes a third one dorsally in the middle line was spotted black. There were two parallel series of black spots on each scale laterally and also on the ventral margin.

The endoskeleton of this specimen was not studied as the skull and vertebral column were badly damaged.

Gland structure.—This snake has a very small parotid gland. The researches of Mme Phisalix and Caius have shown that the secretion from it proved mildly toxic for small vertebrates.

Locomotion.—This was not observed.

Habitat.—Peninsular India (South of Rajputana and the Ganges basin), Ceylon (Wall).

Note:—It was found on the verandah of a bungalow on the 20th February 1934.

Species : **Macropisthodon plumbicolor** (Cantor.). The green Keel-back.

Local name.—'Hara Samp' because of its green colour, any green snake would be so called.

Exoskeleton.—This snake is massively formed for its comparatively small length. The head is large and triangular in shape. The jaws are muscularly prominent. The neck is distinct. The anterior cervical portion is thinner than the rest of the body, which is stoutly built especially about the middle third. The tail is of average tapering length.

Scale formation.—There are large head shields present. The supralabials number 7; the first and second touch the nasals; the third and fourth touch the eye; and the fifth and sixth touch the temporal shields. There is one loreal. The praeoculars number 2 and the postoculars 3. The sublingual shields are in two pairs. The costal scales are retiform, imbricated, and show marked keeling. The last costal rows touching the ventrals are large. There is much variability in the count of the costal scales and this is therefore of little practical value for purposes of identification. On an average they number 23, 25, 19, in the anterior, middle and posterior third of the body. The ventral plates number from 140 to 162, and stretch completely across the belly. The anal shield is divided into 2 sections. The subcaudals are divided throughout and number from 37 to 47.

Colour.—In the adult the colour is a uniform dull green; in the sub-adults there are faint black striations in some; and in older specimens white striations transversely placed at one inch intervals along the back. The very young and older immature specimens show a broad black chevron on the head. Posterior to this is a chrome yellow chevron. Along the back at regular intervals sharp transverse black markings which are continued over the tail. The belly in the adult is white; in the sub-adult slaty, and in the young a bluey black. In the latter along the costal margin there are black markings resembling the capital letter 'I'. Specimens stored in spirit over long periods change to a leaden hue. It is probably because of this that the museum type specimen originally examined led to it being designated *plumbicolor*.

Eye.—This is large. The iris is greenish black and the pupil is spherical.

Length.—The smallest in the series measured 6 in. and the largest 2 ft. 9 in. The naris is laterally placed.

Endoskeleton.—Skull. Dorsally viewed it is broad at the orbits and rectangular in shape. The anterior part is shorter and broader than the posterior. The bones are stout and strong and give to it a heavy appearance. The nasals are medium-sized and are laterally broadly winged. The intermaxillary overrides the maxillary bones. The frontals are broad and suturally united with the praefrontals, which are narrow; both are widely separated from the nasals, and linked with cartilaginous strips. The orbital apertures are large. The squamosals are long, flat and thick. The quadrate is superiorly spatulate, broadly triangular and laterally notched; the inferior articular end is long and terminates in a rounded head. The ectopterygoid is long and thick. The maxillary bones are short, anteriorly slightly thick and articulate with the ectopterygoids at almost a right angle. The maxillaries are peculiarly formed, in that there is a fold in the bone length forming a double convexity on its outer border. Superiorly a process of bone articulates with the inferior border of the praefrontal. The pterygoid is thick, posteriorly broad, ventrally grooved and touches the mandibles. The mandibles are posteriorly broadly built and along with the dentary show a marked convexity on the inferior or ventral surface. The palatines are short.

Dentition.—There are no grooved or perforated fangs—all the teeth are solid. The maxillary teeth number 13. The anterior ones are small and of uniform size. The posterior two are very large and recurved and present the formidable appearance seen in the fangs of the proteroglypha. They are posteriorly ridged and anteriorly rounded and convexed. The palatines have 4—sometimes 5—teeth of one size. The pterygoids are set with 12 teeth of small and uniform size like that of the palatines. The dentary is provided with 18 teeth, those in the middle are slightly larger.

Vertebrae.—The neural spines are large, squared, plate-like extensions. The hypapophysis is well developed and of nearly uniform size throughout the cervical, thoracic and dorsal vertebrae.

Ribs.—Comparatively thicker and longer than in other members of the same family. The free ends are bulbous. The ribs in the anterior third are shorter and longest in the middle third decreasing gradually in the posterior dorsal vertebrae.

Locomotion.—Slow-moving; the spirals are like those seen in *Lycodon aulicus*.

Gland structure.—A large parotid gland. The secretion is toxic for frogs upon which the snake solely feeds.

Habitat.—Peninsular India—except the Ganges valley up to an elevation of 7,000 ft., Ceylon (Wall).

Note:—Appears in large numbers during the rains and is met with in grass lands. It is meek in character and does not bite even when extremely provoked. The neck is partially dilatable. A marked feature is the power of flattening the body and this is more emphasised when the body is touched. The body is splayed out by muscular action, which extends the ribs laterally to such an extent that the dorso-ventral diameter is markedly reduced. The body then appears flush with the ground and the costal scales become isolated islands on the underlying epidermis. This capacity for spreading out the body aided by the green colour makes for excellent concealment in grass lands.

In two gravid females 11 and 19 eggs were found. There were differences in the size of the eggs, some being longer than others. The eggs were in an early state of development and contained only a creamy fluid.

Species: **Lycodon aulicus** (Linn.). The Wolf Snake.

Local name.—None.

Exoskeleton.—The head is flat, large and elongated. The snout is squared. The neck is distinct. The body is uniformly rounded and of proportionate thickness throughout. The tail is of average tapering length.

Scale formation.—There are head shields present. The supralabials number 9; the first and second of these touch the nasals; the third, fourth and fifth touch the eye; and the sixth and seventh the temporal shields. The praeoculars number 2 and the postoculars 3. There is one loreal. The costal scales are retiform, longer than broad, and show apical pits. They number 17, 17, 15, in the anterior, middle and posterior third of the body respectively. The ventral plates number from 200 to 225 and they stretch completely across the belly. The anal shield is divided into 2 sections. The subcaudals number from 40 to 76, and are divided throughout.

Length.—The smallest measured 6 in. and the longest 28½ in.

Colour.—The head is brown. The supralabials are a creamy yellow carried backwards laterally on the nape. The body is pinkish brown and at alternate intervals there are yellowish white bands edged and spotted with black. The scales on the costal margin are marked in the form of the letters K and H in yellow edged with black. These markings both on the back and sides of the body disappear near the tail. The belly is white. The naris is placed laterally in a somewhat forward position on the snout.

Endoskeleton.—Skull. The formation is rectangular in its length, the greatest width being about the orbits. The nasals are long and large. The intermaxillary lies between the maxillary bones and conjointly with them broadens the muzzle. The praefrontals are rectangular in shape, and suturally united with the frontals, the division between the praefrontals and the nasals is occupied by cartilaginous connections. The frontals are small. The parietals are long and centrally ridged in the long axis. The supraoccipital is ridged. The squamosals are thin, small plates of bone. The quadrate is superiorly thinly spatulate and of average length. The ectopterygoid is thin and small. The pterygoid is of average width, ventrally grooved, and touches the mandible. The mandible is posteriorly broadly formed and notched. The dentary portion is thinly formed and long. The maxillary bone, dorsally viewed, shows on the external border a concavity anteriorly and a convexity posteriorly; laterally viewed it is anteriorly broad, with a concavity ventrally and a convexity dorsally, it sweeps downwards, posteriorly thinning out at the articular end in relation with the ectopterygoid. The orbital apertures are large. The palatines are long.

Dentition.—All the teeth are solid and recurved. There are no grooved or perforated fangs. The maxillary bones are set with 15 teeth; their arrangement is peculiar in that the teeth are divided into two series which are separated by an intervening gap devoid of teeth; the anterior set consists of 4 teeth, fixed in a line with the intermaxillary, the two nearest smaller, the outer two large and fang-like; the second series begins at a point just below the praefrontal and the number is 11; the anterior teeth of this series are small, the posterior ones large. The palatines are set with 12 teeth of small and uniform size. The pterygoids are also provided with small uniform-sized teeth numbering 24. The dentary like the maxillary shows the teeth in two series separated by a gap. The first lot consists of 4 teeth of which the first two are smaller than the succeeding two, which are large and fang-like, the second lot number 18, all of them of nearly uniform size. There are some reserve teeth imbedded in the bones on the outer and maxillary border of the palatines and pterygoids, also on the inner aspect of the maxillaries.

Vertebrae.—The neural spines are small squared plate-like extensions. The hypapophysis is large in the cervical vertebrae and gradually diminishes in size up to the end of the last vertebra in the thoracic series. In the dorsal vertebrae the hypapophyses are absent.

Gland structures.—This species has a parotid gland. In addition there is another small pyriform gland situated immediately behind the postfrontal zygoma in the temporal region and communicating with the maxillary teeth by a duct passing under the eye. The secretion from the parotid has been verified by Mme Phisalix and Caius (1917) as producing a toxic condition in small animals. Col. Gharpurey (1932)[1] reported a case No. 4 of a man who was bitten on the face by a young specimen of this species. Except for some local redness and swelling the man suffered no ill effects.

Ribs.—The free ends are pointed. Those in the cervical region are slightly smaller than the ribs in the rest of the body. They are of uniform size and comparatively shorter than in other species of the same length.

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[1] 'Cases of Snake Bite' by Lt.-Col. G. G. Gharpurey, I.M.S., *Journ, Bom, Nat, Hist. Soc.,* vol. xxxvi, No. 1, p. 274.

Habitat.—Peninsular India, Andamans, Nicobars, Malay Peninsula, Indo-China, China, Malay Archipelago, Philippines (Wall).

Note:—A fairly common snake in Deolali and met with all the year round. More prevalent during the monsoon. It is easily provoked and bites on the least provocation.

Species: **Ptyas mucosus** (Linn.). The Rat Snake.

Local name.—'Dhaman'.

Exoskeleton.—The formation in this species is featured by great length, proportionate thickness and a well developed musculature, which suggests a specialisation intended for speed. The head is elongated and the size is in consonance with the body length. The neck is well defined. The body is uniformly rounded and the largest dimension attained is about the middle third. The tail is long and tapering.

Scale formation.—The snout is slightly pointed. There are large head shields present. The supralabials number 8; the first and second touch the nasals, the fourth and fifth touch the eye, and the sixth and seventh touch the temporal shields. There are 1 praeocular, 2 postoculars and 3 to 4 loreals. The costal scales are retiform, imbricated, and longer than broad. On the dorsal aspect the scales for about three rows are slightly keeled and show apical facets. These facets are not seen in freshly killed specimens and appear to be post mortem effects produced by drying. These scales number 17 in the anterior third of the body, 17 in the middle third, and 12 to 15 in the posterior third. The ventral plates number from 196 to 207 and stretch completely across the belly. The anal shield is divided into two sections. The subcaudals are divided throughout and number from 113 to 138.

Colour.—This is variable. The average colour presentation would be that found in specimens 5 feet in length, in which the head shows the appearance of burnt sienna. The supralabials are a creamy yellow and edged with black. The anterior third of the body is uniformly the colour of the head. The middle third is lighter in tone and shows faint creamy yellow striations at intervals edged with black. The posterior third has the striations in black chevron forms. The belly is a creamy yellow and each ventral plate is edged in black. The older specimens exhibit darker colour tones in which the black striations are more subdued and less noticeable.

Length.—The longest specimen secured measured 8 ft. 1 in. and the smallest 3 ft. 4 in.

Eye.—This is large. The iris is yellow and the pupil spherical.

Endoskeleton.—Skull. The bone formation is heavy and a dorsal view shows it to be rectangular. The intermaxillary is large and lies between the maxillary bones. The nasal bone is large and the division between it and the praefrontals is not pronounced. The praefrontals are large and rectangular and from the inferior border anteriorly projected is a process of bone. The frontals are comparatively small for the size and length of this snake. The parietals are large plates which terminate posteriorly in a point. The squamosals are short, flat and thick. The supraoccipital is in the form of a bony crest. The quadrate is long, superiorly broad in the form of a triangle and laterally notched. The ectopterygoid is thin, broad and long and articulates with the maxillary bones at a right angle. The pterygoids are comparatively short, particularly broad in the posterior section, ventrally grooved, and they touch the mandibles. The maxillary bones are proportionately thin, long, and inclined downwards towards the ectopterygoids. The palatines are longer than usual. The mandibles are broadly formed posteriorly and notched. The dentary portion is unusually short, being one-third the length of the mandible.

Dentition.—All the teeth are solid and there are no grooved or perforated fangs in evidence. The maxillary bones are set with 16 solid teeth; the anterior are slightly shorter than the posterior ones. The palatines have 12 teeth and the pterygoids 20; all of these are nearly equal in length to those of the maxillary series. The dentary has in the older snakes, six feet and over in length, 12 and in the younger specimens up to 18 solid teeth. The palatines in the younger snakes have 14 teeth and the pterygoids 22 to 24. There are two rows of reserve teeth on the inner aspect of the maxillary bone imbedded in it above the operative set. On the outer and maxillary side of the palatines and pterygoids above the operative teeth are two rows of reserve teeth.

Vertebrae.—Owing to the length and size of this species the vertebrae are proportionately large. The neural spines are also large and in the form of squared plate-like extensions, except in the cervical series where they are finger-shaped. The hypapophyses are particularly large in the cervical vertebrae and they gradually diminish in size up to the last thoracic vertebrae in which they are rudimentary. The dorsal vertebrae show no evidence of a hypapophysis.

Ribs.—The free ends are pointed. They are long and thick—the greatest length being attained in the middle third of the column.

Locomotion.—This has been shown to be an almost straight course with a slight wavy side to side swing. It is the swiftest moving snake of all the species in Deolali.

Gland structures.—It is equipped with a large parotid gland. The venomous nature of the secretion was demonstrated by Alcock and Rogers (1902)[1] who found it produced convulsions in small animals. Mme Phisalix[2] and Caius (1916) have confirmed this.

Note:—Appears in Deolali at all times of the year but in the greatest numbers during the rains. A half-grown specimen was found on the sloping branch of a monkey fig tree. A gravid female was found to contain a string of 12 eggs. It is notable that not a single very young specimen was encountered during the whole period of the survey.

Species: **Zamenis fasciolatus** (Shaw.). The Fasciolated Rat-Snake.

Local name.—None.

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[1] Alcock and Rogers (*Proc. Roy. Soc.*, vol. lxx, p. 1902) quoted in the *Journ. Bom. Nat. Hist. Soc.* 'Non-Poisonous Snakes' by S. H. Prater, vol. xxxvi, No. 2, p. 393.

[2] 'Animaux venimeux et Venins' by Mme Phisalix, 1922. Tome II, p. 394.

It is generally believed by the local inhabitants that this snake is a female Cobra.

Exoskeleton. It is more slender than *Ptyas mucosus* and shows a proportionate rounded thickness for the length attained. The size of the head is small. The neck is distinct and the cervical region slender. The rest of the body is uniformly rounded and thick. The tail is moderately tapering. There is dorsally and centrally in the long axis of the body a furrow running from the neck to a little short of a point above the vent.

Scale formation.—There are large head shields. The supralabials number 8; the first and second touch the nasals; the fourth and fifth the eye; and the sixth and seventh the temporal shields. The fifth supralabial is very large and reaches up to behind the eye. There is only one loreal. There are 3 praeoculars and 2 postoculars. The costal scales are retiform, imbricated, and longer than broad, not keeled; they numbered 22, 22, 27 (male specimen), and 23, 23, 17 (female specimen), in the anterior, middle and posterior third of the body. The ventral plates completely spanned the belly and numbered 213 in the male and 223 in the female. The anal shield is divided into two sections. The subcaudals numbered 91 in the male and 77 in the female and were divided throughout.

Colour.—The female was of a uniform dark brown shade. The male was a rich light brown. In both specimens the under-surface of the neck was a creamy yellow—as also the infralabials and supralabials. The belly was white.

Eye.—This was moderately large. The pupil spherical. The nares were laterally placed.

Endoskeleton.—The skull is nearly ovate in formation. The intermaxillary is small, dorsally convexed and placed between the maxillary bones. The nasal bones are very large, dorsally convexed and suturally united with the frontals and praefrontals. The praefrontals are nearly square wedges of bone suturally united with the frontals. The frontals are short and narrow. The parietals are fairly long and broad and slightly rounded on the dorsal aspect. The squamosals are comparatively short, thin bony plates. The quadrate is short, moderately spatulate above and laterally smooth. The ectopterygoid is thin, flat and articulates at almost a right angle with the maxillary bone. The pterygoid is moderately broad behind and shows slight, if any, grooving on the ventral surface; it touches the mandible. The maxillary bones are anteriorly broad, posteriorly thin and laterally convexed. The mandibles are posteriorly moderately broad. The dentary is slightly less than half the length of the articular ramus. The mandible in its length is ventrally convexed. The palatines are long.

Vertebrae.—The neural spines are large and square plates. The hypapophyses are well developed in the cervical region and diminish in size in the thoracic vertebrae; in the dorsal vertebrae they are absent.

Ribs.—These are small in the cervical vertebrae and large and of uniform length in the rest of the body except in the dorsal vertebrae where they diminish in length. The free ends are pointed.

Locomotion.—This has not been observed.

Dentition.—The maxillary teeth number 12; the anterior and middle are slightly larger than the posterior ones. The palatine teeth number 9; they are of uniform length. The pterygoids have 14 teeth, equal in length to those of the palatines. The dentary shows a peculiar arrangement; the teeth are set in three lots numbering altogether 14; the first consists of 6 teeth of nearly uniform length, the second of 2 teeth which are the longest, the third of 6 teeth equal to and uniform in length with those placed anteriorly.

Gland structures.—Is provided with a large parotid gland. The toxicity of the secretion has not been investigated.

Habitat.—Ceylon and Peninsular India up to the base of the Himalayas (Wall).

Note:—This is a rare snake in Deolali—only 2 specimens were secured, a male and a female. The male measured 36 in. and the female 47 in. The details as to a sexual association have been earlier referred to. The female was gravid and contained 5 eggs in an early state of development.

Species : **Coluber helena** (Daud.). The Trinket Snake.

Local name.—None.

Exoskeleton.—The snout is obtusely rounded. The head is elongated and flat. The neck is distinct. The body is slightly compressed anteriorly, the rest is of uniform rounded thickness. The tail is moderately tapering.

Scale formation.—There are large head shields present. The supralabials number 10 to 11; the first and second touch the nasals; the fifth, sixth and seventh touch the eye; and the eighth and ninth the temporal shields. The costal scales are retiform, longer than broad, and show apical facets, not keeled; they number 19-25, 22-27, 19-20, in the anterior, middle and posterior third of the body respectively. There is only one loreal. There are 1 praeocular and 2 postoculars. The ventral plates number from 168 to 264 and stretch completely across the belly. The anal shield is entire. The subcaudals are divided throughout and number from 81 to 88. The naris is laterally placed. The eye is large; iris golden, pupil spherical.

Colour.—This snake at first sight bears a colour resemblance to *Rhabdophis stolatus* and in this respect can be easily confused with it. Anteriorly the head is a deep brown, sometimes with a greenish tinge. The supralabials are white. Posteriorly the head and nape are a light pinkish brown. On the nape dorsally and also laterally are black linear streaks running in the long axis. The anterior third of the body shows at intervals 5 to 6 series of broad black bands interspersed with white stippling laid on a background of light pinkish brown. A portion of the middle third of the body is irregularly mottled white, black and brown. The remaining portion of the body shows three series of broad lines laid in the long axis; the intermediate dorsal band is a light brown and those laterally placed are a very dark brown; all of these end on the tail. The belly is white and sometimes faintly tinged with yellow.

Length.—The smallest measured 2 ft. 8 in.—the largest 3 ft. 9 in. This latter one was a gravid female.

Endoskeleton.—The anterior portion of the skull is twice the length of the posterior section. It is ovate in formation. The intermaxillary is free and placed forward in front of the maxillary. The nasals are large and long and the division between them and the praefrontals is very constricted. The praefrontals are specifically large, thick, rectangular in form and suturally united with the frontals; anteriorly they are extended into small processes lying with the nasals. The frontals are long and narrow. The parietals are short in the form of a shield and the posterior portion is extended into a thin, long spicule terminating in a point laid over the supraoccipital. The squamosals are thin, flat and long. The quadrate is superiorly broad and anteriorly rounded; inferiorly it is a long and thin rod of bone. The posterior articular part of the mandible is very broadly formed and notched. The dentary section is thin and long. The ectopterygoid is short, flat and thick. The maxillary bones are thin, narrow, long and curved in the middle portion to form a concavity fitting the convexity of the praefrontals which articulate with them. The pterygoid is posteriorly broadly formed, ventrally grooved and touches the mandible. The palatine bones are long. The postfrontal zygoma is broad and thick. The supra and exoccipital show depressions.

Dentition.—All the teeth are solid and slightly recurved. There are no grooved or perforated fangs. The maxillary has 13 teeth, which are large and of uniform length. The palatine has 7 teeth of a moderately large and uniform character. The pterygoid is provided with 14 teeth; all of them small and of uniform size. The dentary has 18 teeth; the anterior series are very large and the posterior ones diminish in size. There are reserve teeth in two rows on the inner aspect of the maxillaries and on the outer or maxillary side of the palatines and pterygoids.

Vertebrae.—The neural spines are large squared plate-like extensions. The hypapophyses are large in the cervical vertebrae and from thence diminish in size gradually up to the last thoracic vertebra. The dorsal vertebrae show no hypapophyses.

Ribs.—The free ends are pointed In the anterior third of the body they are shorter than in the rest of the body.

Locomotion.—A fairly active snake and moving with a fair degree of speed. The spiral curves are like those of *Lycodon aulicus.*

Gland structures.—This snake has no parotid gland. There is a gland close to the eye behind the postfrontal zygoma in the temporal region. Col. Gharpurey (1932)[1] reported the instance of a woman who was bitten on the forearm by one of this species. The whole forearm was swollen as far as the elbow. There were no after-effects.

Habitat.—Peninsular India including the Himalayas, Ceylon (Wall).

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[1] 'Cases of Snake Bite' by Lt.-Col. K. G. Gharpurey, I.M.S., *Journ. Bom. Nat. Hist. Soc.,* vol. xxxvi, No. 1, dated 15-11-1932, p. 272. Case No. 1.

Note:—An uncommon species in Deolali. The few that were met with appeared during the rains. One was found in the roof of a building under repair.

A gravid female was found to contain 10 eggs in an early stage of development.

Species: **Oligodon arnensis** (Shaw.) The Banded Kukri Snake.

Local name.—None.

Exoskeleton.—The formation is rounded and of a uniform slenderness throughout. The snout is pointed. The head is small and slightly ovate. The neck is slightly demarcated. The anterior third of the body is more slender than the posterior two-thirds. The tail is moderately tapering.

Scale formation.—There are head shields present. The costal scales are juxtaposed and longer than broad. There is no keeling. The supralabials number 7; the first and second touch the nasals, the third and fourth touch the eye and the fifth and sixth the temporal shields, the fourth is the largest. There are 1 praeocular and 2 postoculars. The costal scales number 17, 17, 13-15, in the anterior, middle and posterior third of the body. The ventral plates number 180 to 198 and stretch completely across the belly. The anal shield is divided into 2 sections. The subcaudals are divided throughout and number from 49 to 56.

Length.—The largest measured 1 ft. 10½ in. and the smallest 1 ft.

Colour.—The head is dark brown with a black chevron in evidence. Posterior to this is a lighter brown chevron and behind this again on the nape is another broader angular band of dark brown edged with white. From the neck to the tip of the tail at regular intervals are dark brown and in some reddish brown ovately broad bands edged with white and set on a background of grey or greeny grey. These bands diminish in width and fade into perceptible lines over the tail. The belly in the adult is white and in the young a pale yellow.

Eye.—This is small and the pupil spherical.

Endoskeleton.—Dorsally viewed the skull is triangular in front and semi-ovate behind. The intermaxillary is moderate broad, rounded and overlapped by the maxillary. The nasals are large for the size of the head and the division between them and the frontals indistinct. The praefrontals show a peculiarity in consisting of two pieces suturally united with each other and with the frontals. The frontal bones are broad and short. The parietals are ovately broad and dorsally convexed. The squamosals are fairly short, thin and flat. The quadrate is superiorly spatulate in a somewhat irregular form and inferiorly connected with the mandible by a slender rod of bone. The temporal region is large and bulges laterally. The ecto-pterygoid is particularly large in contrast with the smallness of the species. The maxillary bones are long and broad especially in the posterior half. The pterygoids are posteriorly broad, ventrally grooved and touch the mandibles. The palatines are short. The articular end of the mandible is lightly formed and notched. The dentary is slender and along with the ramus forms a convexity on the ventral surface.

Dentition.—There are no grooved or perforated fangs—all the teeth are solid. The maxillary teeth number 9; the posterior ones are large. The palatine teeth number 6 and are small and uniform in size. The pterygoid is set with 6 teeth, uniform and of the same size as the palatine teeth. They end near to the point where the ecto-pterygoid rests in an articular union. The dentary has 12 teeth, those in the middle are slightly larger.

Ribs.—The free ends are pointed. Those in the middle and posterior third of the body are uniform in length. The anterior ribs of the body are slightly smaller in length.

Locomotion.—The spiral motion is like that of *Lycodon aulicus*.

Vertebrae.—The neural spines are small squared plates. The hypapophyses are well formed in the cervical vertebrae. In the thoracic vertebrae they diminish in size and are absent in the dorsal vertebrae.

Gland structure.—This species has a very small parotid gland. According to the experiments carried out by Mme Phisalix and Caius (1922) the secretion from it produces death in small birds.

Habitat.—Peninsular India including the Himalayas, Ceylon (Wall).

Note:—This species is uncommon in Deolali, appearing just before and during the rains. Does not show any temper, and will not attempt to bite even when extremely provoked. The longest measured 1 ft. 10½ in. and the smallest 1 ft. The nares are placed laterally.

Species: **Oligodon taeniolatus** (Jerd.) **subgriseus** The Variegated Kukri Snake.

Local name.—None.

Exoskeleton.—The formation is slender throughout. The snout is moderately pointed. The head is large in contrast with the body. The neck is slightly demarcated. The body is rounded and of uniform thickness except in the middle third which is slightly larger. The tail is short and moderately tapering.

Scale formation.—There are head shields present. The supralabials number 7; the first and second touch the nasals, the third and fourth touch the eye, and the fifth and sixth the temporal shields. There is one loreal. The praeoculars number 2, and the postoculars 3. The costal scales are retiform and as long as broad; they number 15, 15, 15, in the anterior, middle and posterior third of the body respectively. The ventral plates stretch across the belly and number from 175 to 200. The anal shield is divided into 2 sections. The subcaudals are divided throughout and number from 42 to 56.

Colour.—There is a dark brown band on the head anteriorly and running backwards from this is a linear streak of the same colour, which joins a dark brown chevron collar laid over the nape and around the jaws laterally. Above the eyes are small black linear streaks. Along the body on a background of straw are irregular striations in dark brown or black. These recur at regular intervals and extend over the caudal area where they are less conspicuous. The belly is white.

Length.—The largest measured 1 ft. 4 in. and the smallest 5½ in. The naris is placed laterally.

Eye.—The eye is large for the smallness of this species and the pupil is spherical.

Endoskeleton.—The skull is ovate in formation. The nasals are fairly large in contrast with the small size of the skull and are oval in shape. The intermaxillary is pointed and placed anterior to the maxillary. The frontals are broad and overlap the praefrontals, which are slender strips of bone placed in a perpendicular position over the maxillaries, and are suturally united with the frontals. The parietals are slightly rounded and large. The temporals bulge laterally. The squamosals are short, thin and flat. The quadrate is moderately spatulate above, laterally notched and long in comparison with the size of the skull. The palatines are long. The pterygoids are narrow, slightly grooved on the ventral aspect and touch the mandibles. The maxillary is thin and moderately long. The articular end of the mandible is thinly formed and longer than the dentary, which is short and slender. The ectopterygoid is short and flat.

Dentition.—There are no grooved or perforated fangs. All the teeth are solid. Only the maxillary and dentary are toothed; the palatines and pterygoids are devoid of teeth. The maxillary teeth number 6; all unusually large and out of all proportion to the small-sized skull; the posterior ones are the longest. The dentary teeth number 9, they are comparatively smaller and the anterior are the longest.

Vertebrae.—The neural spines are small squared plates. The hypapophyses are well formed in the cervical vertebrae and diminish in size in the thoracic series. In the dorsal vertebrae they are absent.

Ribs.—The ends are pointed. They are of a uniform small length throughout the body.

Locomotion.—Like that of *Lycodon aulicus.*

Gland structure.—A very small parotid. The secretion, as shown by Mme Phisalix and Caius, is toxic to small birds without, however, killing them.

Habitat.—Peninsular India including the Himalayas, Ceylon (Wall).

Note :—Appears just before and during the rains. It is an uncommon species in Deolali. Mention has been made of a burrowing quality it exhibits. It can be provoked to bite, but is not bad tempered.

SUB-FAMILY : DIPSADINÆ. *'Opisthoglypha'*

Species : **Dipsadomorphus trigonatus** (Schn.) The Common Cat Snake.

Local name : None.

Exoskeleton.—The snout is moderately pointed. The head is large, flat and ovate in shape. The jaws are prominent. The neck is slender and well defined. Anteriorly the body is slender and gradually thickens towards the middle third. It is then of uniform thickness till about the vent. The tail is long and tapering. Dorsally the back is distinctly ridged and laterally compressed. The ventral portion of the body is broad. A section of the body would appear ovately triangular.

Scale formation.—There are fairly large head shields. The supralabials number 8; the first and second touch the nasals; the third, fourth and fifth touch the eye; and the sixth and seventh the temporal shields, the sixth and seventh are the largest. There is one loreal. The praeoculars number 2 and the postoculars 2. The ventral plates stretch across the belly and number from 225 to 245. The anal shield is entire. The subcaudals are divided throughout and number from 74 to 90. Dorsally the vertebral scales in the long axis of the body are enlarged, particularly those in the posterior third of the body. The costal scales are imbricated and much longer than broad; they number 21, 21, 15, in the anterior, middle and posterior third of the body.

Colour.—The background is a dark khaki. The head is black with the imprint of an inverted Y upon it. From above and behind the eye are white linear streaks. A series of irregular chevron-like and confluent white striations at intervals lie along the back. These fade towards the tail. The belly is white and each alternate ventral plate at its costal margin is spotted black.

Length.—The largest measured 2 ft. 9 in. and the smallest 6 in. The naris is placed laterally. The eye is large, the iris black and the pupil vertical.

Endoskeleton.—The skull is ovate in shape. The intermaxillary lies directly between the maxillary bones. The nasals are large and triangular in shape. The frontals are short and broad. The praefrontals are suturally united with the frontals and are broad bony pieces arched forwards and downwards and wider at the articular end placed upon the maxillaries. The parietals are moderately large and the posterior termination is overlapped by the supraoccipital, which is in the shape of a bisected collar. The squamosals are thin, medium-sized, flat bones. The quadrate is superiorly spatulate and long and rod-like inferiorly. The ecto-pterygoid is short, flat and thick. The pterygoid is moderately broad, ventrally grooved and touches the mandible. The mandibles at their articular ends are moderately broad and notched. The dentary is long, slightly thick and broader posteriorly. The palatines are short. The maxillary bones are long and thin. They show on the superior border an anterior convexity and behind this two concave portions—the first of these is long and slightly concave, while the second is deeply concave.

Dentition.—This snake is opisthoglyphous. The maxillary has 10 teeth; the last pair set posteriorly and apart are recurved fangs, large and grooved on the anterior surface; those placed in the forward position are solid and slightly shorter with the points directed inwards. The palatine teeth number 5, they are solid and of uniform length and smaller than the maxillary teeth. The pterygoids have 7 teeth equal in length to the palatine series. The dentary is set with 12 solid teeth, all fairly large, but those placed in the forward position longest.

Vertebrae.—The neural spines are small squared plates. The hypapophyses are well formed in the cervical vertebrae. They decrease in size in the thoracic series and are absent in the dorsal vertebrae.

Ribs.—In consonance with the body formation—the ribs in the cervical section are smaller and gradually increase in length until about the middle third of the body. There is then a proportionate decrease up to the vent. The free ends are pointed.

Locomotion.—The same as in *Lycodon aulicus.*

Gland structure.—This species and *Dryophis mycterizans* of the same sub-family are equipped with a parotid gland, which in structure appears differently constituted from that of the aglypha having a gland in the same position in the head. In this snake the gland is tough, flat, shotty to the feel and of a yellow colour, whereas the gland in the aglypha is a large, white, lobulated mass. In addition to the parotid gland there is another smaller bilobed gland situated in the temporal region behind the postfrontal zygoma and close to the eye; the duct from it passes under the eye to the maxillary bone. Alcock and Rogers (1901) reported on the venomous properties of the saliva of this species. It is undoubtedly toxic and lethal for lizards (*Calotes versicolor*). Mme Phisalix and Caius have found it highly toxic to the mouse.

Habitat.—Peninsular India including the Himalayas, Ceylon (Wall).

Note:—A fairly common snake in Deolali. Is in evidence throughout the year, but appears in greater numbers during the rains. One gravid female was found to contain 9 eggs. These were elongated in form and showed variations in the length.

This species is bad tempered. It is very easily provoked to bite. Once its temper is aroused it shows its rage by forming the anterior third of its body into a figure of eight and with the head erected and ready to dart it waits impatiently vibrating the tail.

Species: **Dryophis mycterizans** (Linn.) The Green Whip Snake.

Local name.—Because of its green colour it is called 'Hira Samp' or green snake.

There was only one specimen secured and examined.

Exoskeleton.—The formation is characteristically slender throughout. The snout is markedly protruded into a long fine point. The head is rounded dorsally, laterally compressed and elongated. The anterior portion of the body is very slender and there is no distinction or constriction denoting the neck. The rest of the body is thicker but the slender proportions are maintained. Dorsally the body is ridged and laterally compressed. The tail is particularly long and whip-like and rather rounded than compressed.

Scale formation.—There are head shields of an elongated form in correspondence with the head formation. The rostral shield is specifically long and pointed. The supralabials number 8; the first touches the nasal, the fourth and fifth touch the eye (it should be noted that the fourth is divided into three parts of which the two uppermost touch the eye), the sixth and seventh touch the temporal shields. There are 1 praeocular and 2 postoculars. The costal scales in the middle and posterior third of the body are rounded and as long as broad; those in the anterior part of the body are imbricated and much longer than broad. The central dorsal scales along the back are enlarged. There is no keeling in evidence. The costal scales numbered 15, 16, 13, in the anterior, middle and posterior third of the body. The ventral plates stretched across the belly and numbered 185. The anal shield is divided into 2 sections. The subcaudals were divided throughout and numbered 139.

Colour.—This was a foliage green throughout. Two yellow lines ran the whole length laterally and in the long axis of the body. The supralabials were yellowish green. The undersurface of the neck was white and the belly green. The specimen measured 3 ft. 10 in. in length.

The eye was small and the pupil horizontal. The naris was laterally placed.

Endoskeleton.—The skull is elongated. The intermaxillary is broad posteriorly and anteriorly projected to a fine point; it lies between the maxillary bones. The nasals are particularly enlarged and ovately elongated; the division between them and the frontals and praefrontals is narrow. The praefrontals are large and triangular in shape with the apex projected forward. The frontals are short and narrow and suturally united with the praefrontals. The parietals are long and the posterior end is attenuated and laid over the supraoccipital which shows two depressions. The squamosals are thin and long and shaped like a boomerang. The quadrate is long and broadly curved and notched; it is anteriorly and inferiorly concave and posteriorly and superiorly convexed. The maxillary bones show two sections joined together by a thin bridge of bone; the anterior section is broad and the posterior one thin. The ectopterygoid is short, thick and flat. The palatines are short. The pterygoid is broadly formed posteriorly, ventrally grooved and touches the mandible. The articular end of the mandible is broadly fashioned, winged and notched. The dentary section is clubbed anteriorly.

Dentition.—Owing to the formation of the maxillary bone the teeth set in it are in two lots; the anterior series number 7, of which the posterior ones are large; the second lot number 7 and here the last two are large, recurved and grooved on the anterior surfaces. The palatines have 6 solid teeth; the anterior ones are large. The pterygoid teeth number 19; those set anteriorly and towards the middle are larger than the posterior ones. The dentary like the maxillary because of its formation shows a peculiar arrangement; the peculiarity here is a close copy of the setting seen in the dentary of *Lycodon aulicus*. To the thicker or clubbed end of the bone are fixed 4 large recurved solid teeth; the two anteriorly set are shorter than the succeeding pair which are well developed; there is then a gap followed by a second series of smaller teeth numbering 16, of which the first 4 are long and the rest of small and uniform length.

Vertebrae.—In keeping with the slender make-up of the body, the vertebrae show a long and narrow formation, and the dorso-ventral diameter is short. As has been previously mentioned in this paper, the first cervical is ½ a millimetre larger than the second. The succeeding vertebrae gradually increase in size, until the anterior dorsal vertebrae are reached, where the maximum depth, width and length is attained. The measurements are 5 mm. and 7 mm. dorso-ventrally and antero-posteriorly respectively, as compared with the largest dorsal vertebra of *Ptyas mucosus* which measures 11 mm. in both directions. Thereafter the vertebrae correspondingly gradually decrease. The neural spines are short dorso-ventrally and very long. They are squared plate-like extensions. The hypapophyses are well developed in the cervical region and gradually diminish in size in the thoracic section. In the dorsal division they are absent. The caudal vertebrae are very numerous and structurally delicate.

Ribs.—The free ends are pointed. The formation is slender, both in length and thickness. They are shorter in the cervical section and slightly longer and of uniform length in the rest of the body, except posteriorly in the dorsal vertebrae, where they decrease in size.

Gland structure.—Same as in *Dipsadomorphus trigonatus.* Alcock and Rogers (1902) showed the saliva to be toxic to the mouse. Later Mme Phisalix and Caius (1918) confirmed those results and found moreover that the saliva was also toxic to small birds and to toads. Mr. McCann (April 1934)[1] graphically describes the incident of one of those snakes feeding on a lizard and mentions the convulsions noted in the lizard as a result of the venom injected. He also claims to have been bitten by one of them without any ill effects ensuing.

Habitat.—Peninsular India, excluding the valley west of Patna, Ceylon, Siam, Indo-China (Wall).

Note:—The specimen secured here is apparently a half-grown snake, as the example quoted by Mr. Prater (1926)[2] (Bombay, F. Birkett) measured 6 ft. 11 in. It is a rare snake in Deolali and was secured by Mr. Fenton-Bailie. The slender formation, leaf-shaped head and green colour are adaptations admirably suited to an arboreal existence.

SUB-FAMILY: ELAPINAE *Proteroglypha.*

Species: **Bungarus caeruleus** (Schn.) The Common Krait.

Local name: 'Cowrieala' because of the colour resemblance to a variety of sea shell.

Exoskeleton.—The formation presents a nearly uniform thickness throughout. The snout is rounded. The head is large and of a proportionate size to the body. The neck is distinct. The body is uniformly thick and the tail is moderately tapering.

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[1] 'A Whip-Snake feeding on the Lizard', by C. McMann, F.L.S., *Journ. Bom. Nat. Hist. Soc.*, vol. xxxvii, No. 1, p. 226.

[2] 'The Snakes of Bombay Island and Salsette' by S. H. Prater, C.M.Z.S. April 1926, p. 28. Reprint from *Journ. Bom. Nat. Hist. Soc.*, vol. xxx, No. 1.

Scale formation.—There are large head shields. The costal scales are retiform and rounded. The dorsal scales centrally along the back are enlarged and hexagonal, a specific character. In young specimens 10 to 12 inches long, the large scales on the back begin at a point about two head lengths away from the head; those in the middle third of the body are the largest. The supralabials number 8; the first and second touch the nasals, the third and fourth touch the eye, and the seventh and eighth the temporal shields; in one example the fourth, fifth and sixth touched the eye. There is no loreal. There are 1 praeocular and 2 postoculars. The costal scales number 15, 15, 15, in the anterior, middle and posterior third of the body. The ventral plates are large and stretch across the belly and number from 216 to 222. The anal shield is entire. The subcaudals are undivided throughout and number from 48 to 52.

Colour.—The head and background of the body are uniformly black, but some young specimens show up as dark brown. Dorsally and centrally along the back at short regular intervals are white spots and laterally uprising from the ventral margins are transverse linear white rings nearly meeting the aforementioned spots; the white rings are more prominent posteriorly. The belly is white. Specimens immersed in spirit over long periods of time change to a bluey black.

The eye is large and the pupil spherical. The nares are laterally placed.

Length.—The largest measured 3 ft. 10 in. and the smallest 10 in.

Endoskeleton.—The skull is elongated and slightly narrow in form. The anterior portion is heavily built and short, while the posterior section is much longer. The intermaxillary is convexed anteriorly and widely separated from the maxillary bones. The nasal bones are wide and long. The frontals are thick, short and dorsally convexed. The praefrontals are anteriorly and laterally convexed; they are thick and narrow above where there are sutures dividing them from the frontals, and broadly formed inferiorly at their convexed articular junction with the maxillaries. The parietals are triangular and long, terminating behind in a thin point crossing and laid over the supraoccipital crest. The temporals are large and bulging in character. The squamosals are particularly slender, thin, flat and short in contrast with the general heavy formation of the skull bones. The quadrate is very short, thick and spatulate above. The maxillary bones are thick, short and strongly built; they are broad in front, superiorly concave and laterally and inferiorly convexed; on the inner ventral aspect they are concave. The ectopterygoid is anteriorly thick and strongly fashioned, having a spatulate form at the articular end laid over the maxillary, posteriorly it is long and thins down to the point articulating with the pterygoid. The pterygoid, posteriorly, is moderately broad, ventrally grooved and touches the mandibles. The palatines are long. The basioccipital is ridged.

The mandibles are stoutly built, being of nearly equal thickness throughout their length, the posterior part is notched and is slightly broader than the anterior or dentary portion.

Dentition.—The maxillary bones have two moderately developed, canaliculated, recurved fangs anteriorly set. The apertures of these fangs are placed on the anterior surface a little above their sharp points. There is then a gap in the bone, followed by a group of 4 solid teeth. These are small and of uniform length. The palatine teeth number 7, they are solid and of uniform size, but slightly smaller than the solid teeth set in the maxillary bones. The pterygoids have 12 solid teeth, equal in size to those of the palatines. The dentary is provided with 18 to 20 solid teeth; those anteriorly placed are large and the teeth diminish in size from before backwards.

Vertebrae.—The chief specific character is the winged extensions or alae projected laterally on either side of the neural arches. In this respect this species is unique and unlike any of the other in Deolali. The neural spines are large squared plate-like extensions. The hypapophyses are well developed throughout, but gradually diminish in size from before backwards. Another distinguishing feature is the marked wing-like formation of the rib-like processes fused with the bodies of the cloacal and caudal vertebrae, two such in the former and one in the latter on either side of the vertebrae.

Ribs.—These, in conformity with the rounded thickness of the body are of nearly uniform length. They are stoutly formed and the free ends are blunted.

Locomotion.—This has not been observed.

Habitat.—Ceylon, Peninsular India, including the Himalayas up to 5,000 ft. (Wall).

Note:—This species probably exists in greater numbers than were actually found. It can be considered as fairly common in Deolali. It may be remarked that the young krait is less often a dark brown in its colour background, hence it is that young and sub-adult specimens of *Lycodon aulicus* because of a like colour and part design presentation, are often mistaken for this species by those who are unacquainted with the other specific characters which distinguish them. No specimens were found with the alimentary canal containing an ingested meal. They are said to feed on rats and are threfore frequently met with near to and in human habitations. Little is known as to their habits. Other workers have found this species to be inoffensive and not prone to bite, even when greatly provoked. The fatalities recorded from bites of Kraits, however, show that they in common with most other animals have limitations placed upon their patience. The fact that they have a potent venom provision and canaliculated fangs in itself points to some aggressive quality.

Species: **Naia naia**, *var.* **caeca** (Merr.)
Naia tripudians (Merr.). The Binocellate Cobra

Local name.—'*Nag*'.

Exoskeleton.—The head is flat and slightly elongated. There is no neck division, rather this region is dilatable and in the erected state the cervical division is indicated by an expanded hood. The body is dorsally ridged and laterally slightly compressed; it is anteriorly well developed and diminishes in thickness from before backwards. The tail is cylindrical and tapering.

Scale formation.—The costal scales are imbricated, longer than broad and longest in the anterior part of the body. There are large head shields. The supralabials number 7; the first, second and third touch the nasals; the third and fourth touch the eye; and the fifth and sixth the temporal shields; the third is the largest. There is no loreal. The one praeocular touches the nasals, and there are 2 postoculars. There is an important specific peculiarity in the presence of a cuneate scale—sometimes 2—wedged in above the fourth and fifth infralabials. The costal scales vary in the counts from 19, 20, 13, to 29, 25, 16, in the anterior, middle and posterior third of the body. Col. Wall (1928)[1] has emphasised the peculiar formation of the costal scales; these show a concavity at the posterior junction of each row and the next. The ventral plates stretch completely across the belly and number from 188 to 199. The anal shield is entire. The subcaudals are divided throughout and number from 52 to 65.

Colour.—Varies in shade—black, brown, straw or buff. There are markings of black and white in the shape of spectacles (binocellate) on the hood. The belly is white and anteriorly on the ventral aspect of the hood there are black bands and some spots.

Length.—The longest measured 4 ft. 8½ in. and the smallest 7 in. The eye is large and the pupil spherical.

Endoskeleton.—The general presentation is a symmetry and lightness in the formation of the head bones. Anteriorly the skull is trefoil in shape and posteriorly it is narrow and squared. The intermaxillary is specifically large; it is dorsally and anteriorly convexed and projected beyond and separated from the maxillary bone. The nasals are large and suturally divided. The praefrontals are thin, narrow, convexed strips of bone projected downwards and suturally united with the frontals above; they are notched on the anterior and inferior border on the inner side and the division between them and the nasals is slight. The frontals are short and broad. The parietals are equilaterally triangular with the apex placed over the supraoccipital. The temporals are well developed and bulge laterally. The supraoccipital is circularly ridged in the form of a crest. The maxillary bones are broadly formed anteriorly, and they posteriorly thin down, they are laterally convexed and ventrally and dorsally concave. The ectopterygoids are thin, long, flat, narrow and laterally convex; the articular end laid on the maxillary bone is slightly spatulate. The palatines are short. The pterygoids are posteriorly moderately broad, ventrally grooved and touch the mandibles. The squamosals are short, thick and flat. The quadrate is long, broadly spatulate above, anteriorly extended and laterally notched. The mandibles are comparatively slender in formation; the posterior articular end is moderately broad and notched. The dentary portion is short and slender.

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[1] 'The Poisonous Terrestrial Snakes of our British Indian Dominions etc, etc.' by Col. F. Wall, I.M.S., K.H.S., C.M.Z.S., 1928, p. 26.

Dentition.—The maxillary bones show the proteroglyphous fangs, two in number, one operative and the other held in reserve, fixed to the broadly formed anterior portion of the bone. Both these fangs are canaliculated and the aperture for the exit of the poison is placed anteriorly and superiorly above the fang points. Below these fangs and on the inner and concave portions of the maxillary bones is one small solid tooth. In the lateral view the reserve poison fang is not visible, as it is in the recumbent position bent in on the ventral concavity of the maxillary. The palatines have 5 solid teeth; those anteriorly placed are larger. The pterygoids are set with 11 to 12 solid teeth of uniform length. The dentary has 12 solid teeth; those in the forward position are large and recurved and the teeth diminish in size from before backwards.

Vertebrae.—The neural spines are small and nearly square plates. The hypapophyses are well formed in the cervical section and they gradually diminish in size until the last dorsal vertebra in which it is considerably reduced.

Ribs.—The cervical region shows the longest ribs in the section corresponding to the hood. From thence the ribs decrease in length from before backwards. The free ends are pointed.

Locomotion.—A fairly fast-moving snake. There is a slightly more wavy side to side swing than in *Ptyas mucosus.*

Gland structure.—This is so well known that it scarcely requires any description. There is a large aciniform gland between the eye and the angle of the mouth. It secretes a potent venom in any quantity up to 1 c.c. Lamb's estimate (quoted by Col. Wall, 1928),[1] of the number of bitten subjects who escape with a sub-lethal dose is put at 30 per cent. It is one of our deadly venomous snakes.

Habitat.—Ceylon, Peninsular India, including the Himalayas up to 5,000 ft., Burma (Wall).

Note:—It is fairly common in Deolali. In evidence at most times of the year, but more especially during the rains.

It is not vindictive and will not go out of its way to attack. Its first desire is to effect escape but if molested it will face the tormentor. It then at once assumes the defensive by erecting the head, expanding the hood and watching one's every movement, awaiting an opportunity to bite and further intimidating by hissing. It is because of this behaviour that it is easily caught and killed.

Species: **Callophis trimaculatus** (Daud.) The Slender Coral Snake.

Local name.—None.

Exoskeleton.—The formation is slender throughout. The neck is not demarcated. The body is uniformly rounded and slender. The tail is short and abruptly terminates in a point.

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[1] 'The Poisonous Terrestrial Snakes of our British Indian Dominions, etc.' by Col. F. Wall, I.M.S., K.H.S., C.M.Z.S., 1928, p. 75.

Scale formation.—There are small head shields. The supralabials number 6; the first and second touch the nasals; the third and fourth touch the eye; and the fifth and sixth the temporal shields; the third is the largest of the series. There are one praeocular and two postoculars. The costal scales are smooth, as long as broad and diamond-shaped; they number 13, 13, 13, in the anterior, middle and posterior third of the body. The ventrals stretch across the belly and number from 250 to 272. The anal shield is divided into two sections. The subcaudals are divided throughout and number from 26 to 32.

Colour.—Head tarry black, and speckled white as follows:—One large white spot on each temporal shield. There are 4 white scales behind the parietal shields. The black markings are edged with white and laterally run in scolloped edges on to the neck and side of upper and lower jaw. The body is uniformly buff or yellowish brown. Dorsally, on the tail and a little short of its tip, is a black irregular band edged with white. About one inch anteriorly to this is another similar and slightly larger black band also edged with white. The belly is a coral pink up to the vent. The subcaudals are white with black irregular markings.

The eye is small—pupil spherical, iris black. The nares are laterally placed.

Endoskeleton.—The skull is elongated. The anterior portion of it is broader than the posterior section. The intermaxillary is projected forwards and away from the maxillary. The nasals are as large as the frontals, and both are suturally divided. The praefrontals are thin, circular, arched strips of bone continued over the orbit and fused with the postfrontals behind; they are suturally divided from the frontals. The parietals are large and rounded and show no division; the original suture is seen in young specimens 9 inches long. The temporals are as long as the parietals. There are no squamosal bones. There is a fused irregular mass in the shape of a rounded portuberance placed over the mastoid region which shows no distinction as between a true, separate squamosal and mastoid eminence. Upon a smooth surface of this projected mass the quadrate articulates. The quadrate is superiorly spatulate and projected backwards, it is of proportionate length with the size of the skull. The maxillary bones are short, thick and well developed for so small a skull; they are thicker anteriorly, and posteriorly thin and notched. The anterior end of the ectopterygoid is adapted to fit the notched end of the maxillary and is firmly wedged to it. The ectopterygoid is thin and long and forms the base of the orbit. The turbinal bones are thick and show a heavy formation. The palatines are short. The pterygoids are thin, long strips of bone and of a uniform character throughout without any ventral grooving; they touch the mandible. The mandibles are thinly formed and the ramus portion is roughly four times longer than the dentary section.

Dentition.—To the maxillary bones in their anterior portions are set two small, recurved and canaliculated fangs. One is operative and the other held in reserve. The reserve fang is recumbent and bent in on the ventral aspects of the maxillary bones. It is not generally seen in a lateral view. The apertures of the fangs, as is usual with the proteroglypha, are anteriorly and superiorly positioned above the fang points. The palatines have three small, solid teeth, while the pterygoids are devoid of them. The dentary has 2 solid teeth set widely apart.

Vertebrae.—The vertebrae are small and delicately formed. There are no neural spines. The hypapophyses are proportionately long and gradually diminish in size up to the last dorsal vertebra.

Ribs.—The free ends are pointed. They are slender in formation and of nearly uniform length throughout.

Locomotion.—The spiral curves are deep and like those depicted for the Russell's Viper.

Gland structures.—A small aciniform gland situated in the temporal region, behind and away from the eye. Nothing is known as to the poisonous properties of the venom. Although built on very small and delicate lines this species falls into the Thanatophidia, because of the anatomical similarity of its venom gland and the presence of perforated fangs. The quantity of venom secreted must necessarily be small in amount. The point as to whether it is capable of injecting a lethal dose has not been ascertained.

Habitat.—Ceylon, India: South Deccan, Kanara and Bengal (Wall).

Note:—This species is uncommon in Deolali. When touched they behave in a peculiar way by erecting and rolling up the caudal section dorsally into a ringed formation. In doing this the coral and black and white stained surfaces of the belly and subcaudals become exposed. This trait is probably an intimidatory effort to stay further molestation. What exactly they feed upon has not been ascertained. The thinly delicate formation of the body and the smallness of the head with few small teeth in it precludes any capacity for seizing and swallowing larger living things than centipedes, millipedes and insects.

FAMILY: VIPERIDÆ.

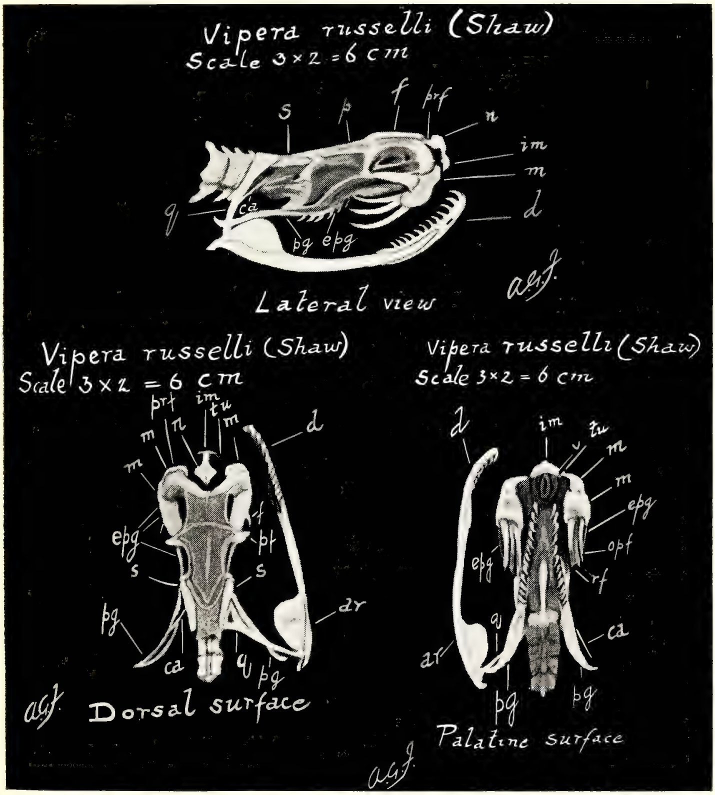
SUB-FAMILY: VIPERINÆ.

Species: **Vipera russelli** (Shaw.) The Russell's Viper.

Local name.—None exists—probably due to the fact it is rare in these parts and seldom seen.

Exoskeleton.—Shows a massive formation throughout. The head is large, flat and triangular. The muscular development around the jaws is a marked feature. The neck is well defined. The body is very thick and round. The tail is dumpy, stoutly formed and abruptly terminates.

Scale formation.—The costal scales are imbricated, longer than broad and heavily keeled; they number 27, 29, 21, in the anterior, middle and posterior third of the body. The supralabials number 12. There is an absence of head shields. The sublinguals are in one pair. The ventral plates stretch across the belly and number 56 and 60. In the larger specimen the three terminal subcaudals


Vipera russelli (Shaw)
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Palatine surface
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The Russell's Viper (*Vipera russelli*).

were entire. The anal shield is entire. There is no uveal pit between the eye and the muzzle.

Colour.—The background is earthy brown with three series of black patches. The dorsal row, running centrally along the back, and large and leaf-shaped and confluent, those laterally situated are smaller and ovate and lie below and between the dorsal patches, and in places run on to the belly. All of these blotches are edged with white. There are black linear markings over the eyes and the snout. The rostral shield, the supralabials and the infralabials are orange-tinted and speckled with black. The belly is white.

Eye.—This is large. The pupil is vertical and the iris golden.

The nares are placed slightly superiorly and laterally in a forward position.

Length.—There were two specimens only. The larger measured 4 ft. 6 in. and the smalled 3 ft. 8 in.

Endoskeleton.—Anteriorly the skull shows a heavy bone formation. Posteriorly it is dorsally narrow and deep dorso-ventrally. The intermaxillary is small and placed in a forward position away from and above the maxillary. The nasals are small and shaped like the ace of diamonds. The division between them and the praefrontals is pronounced and linked over by cartilaginous connections. The turbinals are heavily formed. The praefrontals are thick, strongly built bones, dorsally and anteriorly convexed and fused together in front of the frontals from which they are divided by a suture. The frontals are short and broad. The parietals are small and anteriorly convexed, centrally ridged and posteriorly conically projected. The temporals are concavely depressed. The mastoid portion of the skull is prominently ridged and faceted for the articulation of the squamosals, which are thin, moderately long and flat. The quadrate is very long, posteriorly convexed, superiorly spatulate and laterally notched. Inferiorly it is rod-like and curved, showing a convexity posteriorly. The maxillary bones are massively formed and vertically fixed; in the relaxed state they are inclined backwards with the fangs bent in against the ectopterygoid. Superiorly, the articular surface for the reception of the praefrontal is concavely faceted. The rotary motion of the maxilla upon the convexed inferior border of the praefrontal projects the fang forward to an extreme degree. Anteriorly the maxilla shows a double convexity divided medially by a transverse constriction. Inferiorly it is broadly formed and shows the alveolar bony sockets for the reception of the fangs which are ankylosed to it. The ectopterygoid is thin, long and flat and arched backwards; the anterior section of it is broadly spatulate and winglike, the posterior part narrows down and is angular at the point where it is laid upon the pterygoid in articulation. The pterygoid is moderately broad, ventrally grooved and does not touch the mandible. From the surface of the basi-sphenoid projected downwards and backwards is a process similar in shape to the hypapophyses of the vertebrae. To this process is attached the longus colli muscle. The mandibles are long and uniformly thick. The articular end is broadly formed, superiorly winged and slightly notched. The dentary portion is moderately sized.

Dentition.—To the maxillary bones, in the one specimen examined, are ankylosed three canaliculated recurved fangs. One is operative and the other two are held in reserve. In the living specimens the two reserve fangs are encased in a mucous capsule. All of these fangs show formidable proportions and are much larger than any of the fangs noted in the proteroglypha. There are five solid recurved teeth set in the palatine bones. The pterygoids show seven teeth equal in size and length to those of the palatine. The dentary has 12 solid teeth, those anteriorly set are larger, and the teeth diminish in size from before backwards.

Vertebrae.—The cervical series are well defined by their finger-like neural spines. The thoracic vertebrae are differentiated by their squared neural spines being long dorso-ventrally in contrast with the dorsal vertebrae in which the neural spines are short squared extensions. The hypapophyses are well developed and of nearly uniform length throughout the first three vertebral divisions. The pseudo rib processes fused with the bodies of the cloacal and caudal vertebrae are long, slender, rounded rods as compared with the Colubridae in which they are short, slightly flattened blades.

Ribs.—These are strongly fashioned. The terminal ends are pointed. They are shorter anteriorly and increase in length. The longest and thickest dimensions are attained in the anterior and mid-dorsal series. From thence backwards there is a gradual decrease in length and thickness.

Locomotion.—The spiral curves are deep and the movement is slow and unwieldy. The writer killed one when in active motion on the Dharampur-Sabathu road (Simla Hills) in 1929. It was easy to keep up close behind the snake at not more than a walking pace.

Glandular structures.—There is a large densely lobulated gland on either side below and behind the eye. The venom is highly complex and the lethal quality of it is well known.

Habitat.—Ceylon, Peninsular India excluding the Ganges valley, Burma and Siam.

Note:—This is uncommon in Deolali. It is a hissing snake and will bite on the least provocation. Both the specimens secured were killed in the precincts of Barnes High School, Deolali. The single specimen examined by dissection proved to be a female. The other is preserved in the collection belonging to Mr. Fenton-Bailie of Barnes School. Mr. Flynn (1932)[1] records that a male and female secured by him on 25th April, 1929 were kept in a specially constructed box. On 12th July of the same year, 79 days after, he found the glass case swarming with young snakes. He collected thirty-three in all, twenty-seven were fully developed and six immature and dead and adherent to portions of the egg envelope. He remarks that the markings on the young were distinct and differed from the parent snake, being slaty grey above and light cream below.

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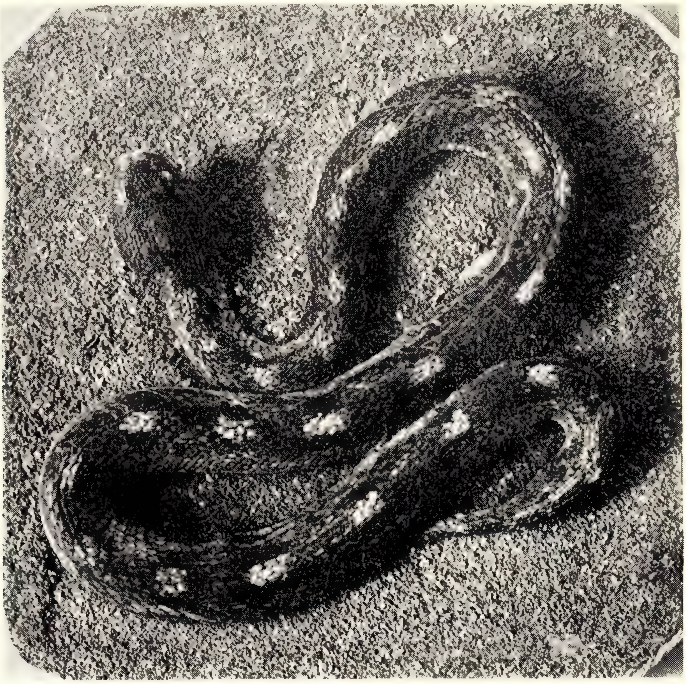
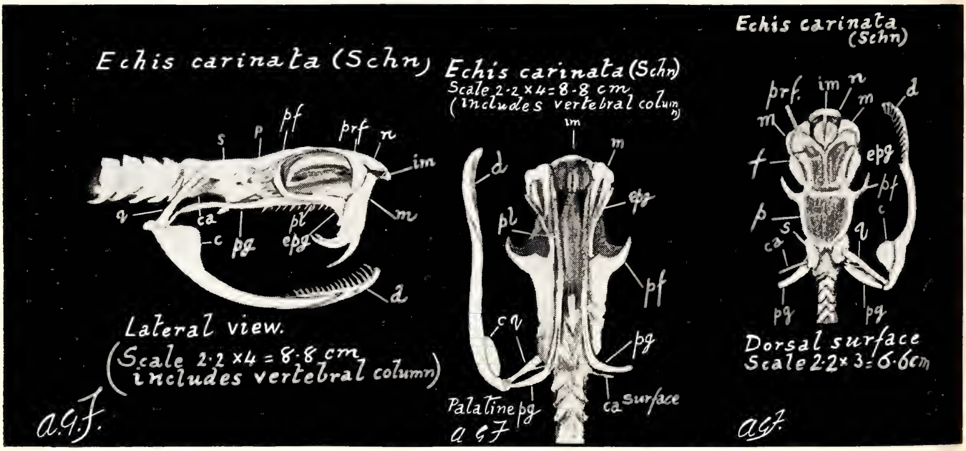
[1] 'The Family of a Russell's Viper' by A. A. L. Flynn, V.D., C.M.Z.S., *Journ. Bom. Nat. Hist. Soc.*, vol. xxxvi, No. 1, p. 271.

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Lateral view.
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Echis carinata (Schn)
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Dorsal surface
Scale 2·2x 3 = 6·6cm
a.g.J.

The Saw-scaled Viper (*Echis carinata*).

Species : **Echis carinata** (Schn.) The Saw-scaled Viper.

Local name.—Phoorsa.

Exoskeleton.—The snout is obtuse. The head is small rounded and with a muscular prominence around the jaws. The body is stoutly built for so small a snake. The tail is short, thickly formed and abruptly terminated.

Scale formation.—The scales are imbricated, longer than broad, and heavily keeled. The supralabials number 9. There is only one pair of sublinguals. There are no head shields, and the uveal pit is absent. The postral is well defined. The costal scales vary in number from 23-27, 24-27, 21-23, in the anterior, middle and posterior third of the body. The ventral plates stretch across the belly and number from 145 to 155. The anal shield is entire. The subcaudals are entire. In two examples the first subcaudal below the anal shield showed a division.

Colour.—The background is earthy brown and in young specimens slaty. On the head there is the imprint of an arrow head. Dorsally on the back there are a series of white ovate spots edged with black. These white blotches are connected by white irregular striations running dorsally and laterally and enclosing patches of a darker shade. At first sight the colour and part design presentation are very like those of *Dipsadomorphus trigonatus.*

The eye is large and bulging. The pupils are vertical. The nares are placed slightly superiorly in a forward position.

Length.—The shortest measured 6¼ in. and the longest 19½ in. They are said to grow up to 2 feet.

Endoskeleton.—Anteriorly the skull shows a heavy bone formation. Posteriorly it is very narrow. The orbits are large for the small size of the skull. The intermaxillary bone is projected forward and separated from the maxillary bones. The nasals are small. The maxillaries are broad, thick, heavily formed and set obliquely. Superiorly the maxillary bone shows a process which abuts against the praefrontal and is chiefly involved in the articulation with it. The process itself posteriorly is concave and adapted to rotate on the praefrontal convexity. The anterior and lateral surfaces of the maxillary are slightly convex and slope downwards and slightly backwards. Like in the Russell's Viper this bone in the relaxed state is inclined backwards; the inferior surface is convexed and its posterior border shows an alveolar ridge to which are ankylosed the fangs. The maxillary bones are specifically large and well developed for so small a snake. The praefrontals are also large and heavily formed, they are fused together in front of and in the adults with the frontal bones. In the younger snakes a suture divides them from the frontals. The frontal bones are dorsally convexed, medium sized and in the adult, centrally ridged by ossification, but in the young they are divided by a suture. The parietals are also in the adult dorsally slightly convexed and centrally ridged and in young specimens suturally divided. The post-frontal zygomatic process juts out laterally. The temporals are depressed by a sulcus for the muscle and lodgement of the poison gland. The squamosals are short, broad and flat. The quadrates are long rods of bone slightly spatulate inferiorly. The ectopterygoids are anteriorly broadly winged and convexed and adapted to fit the concave articular surfaces of the maxillaries; posteriorly they terminate in a point laid over the pterygoids. The pterygoid bones are vertically set narrow plates, and posteriorly are slightly grooved on the ventral aspects and touch the mandibles. As in the case of the Russell's Viper, a process is projected from the basi-sphenoid, downwards and backwards and resembles in formation the hypapophyses of the vertebrae. The mandibles are ventrally convexed and rounded; superiorly the ramus portion is winged and notched. The dentary portion is short and lightly formed.

Dentition.—The number, setting and arrangement of the proteroglyphous fangs and the solid teeth are identical with those of the Russell's Viper, except that in this snake the dentary is set with sixteen instead of twelve solid teeth.

Vertebrae.—As described for the Russell's Viper, only proportionately smaller.

Ribs.—As described for the Russell's Viper.

Locomotion.—The same as for the Russell's Viper.

Gland structure.—Conforms with that of the Russell's Viper and is proportionately smaller. Lethal doses of the venom produce fatalities in man and in some cases there is a delayed action.

Habitat.—Ceylon, Peninsular India, Baluchistan, Afghanistan, Transcaspia, Persia, Arabia and Africa—north of the Equator.

Note :—Altogether 6 specimens were encountered. Five of these belonged to Mr. Fenton-Bailie's collection. It is an uncommon species in Deolali.

SPECIES EXTRANEOUS TO DEOLALI

FAMILY : COLUBRIDÆ.

SUB-FAMILY : DIPSADINÆ *'Opisthoglypha'*.

Species: **Dipsadomorphus beddomei** (Fitz.)

This specimen reached Deolali in a sewn sack of potatoes. The particular sack was issued to the British Troops Ration centre at Munroe lines, Deolali on the 11th September, 1934. When the sack was opened and the potatoes were rolled out on the floor the live snake was discovered and killed. It was identified as noted above. Further inquiry from the Officer in charge of Supplies elicited the information that a consignment of potatoes had been received by the Contractor from Mahableshwar (Deccan) and the sack in question belonged to that consignment.

Exoskeleton.—The formation is slender for the length of the specimen. The snout is obtuse. The head is oval and the neck distinct. The cervical section is slender. The body in the middle third is thicker, laterally compressed and dorsally ridged and posteriorly it thins out. The tail is rounded, very long and tapering.

Scale formation.—The scales are imbricated and longer than broad. The dorsal scales which are centrally placed in the long axis of the body are enlarged and equal in size to those of the

Krait. These scales are particularly large in the posterior third of the body. The costal rows of scales numbered 19, 19, 13, in the anterior, middle and posterior third of the body respectively. The supralabials numbered 8; the first and second touched the nasals; the third, fourth and fifth touched the eye; and the sixth and seventh the temporal shields. There was one loreal. The praeoculars and postoculars numbered 2 each. There were two pairs of sublinguals. The infralabials numbered 10. The anal shield was entire. The subcaudals numbered 112 and were divided throughout. The ventrals numbered 246 and stretched completely across the belly.

Colour.—The background was a brownish khaki. The head was brown and deeply tinged with yellow between each shield and scale division. The supralabials, infralabials and the under-surface of the neck were stained a deep yellow. The nape of the neck was irregularly spotted with black. The anterior half of the body was a brownish khaki. The belly in this section was yellow. The posterior half of the body was a light yellowish brown and the belly in this portion was white. There were irregular faint striations in black along the back. About the middle third these striations were more chevron-like in formation. The costal margins were spotted black in two parallel series decreasing towards the tail.

Length.—36 in. Sex :—female.

Eye.—This was fairly large and bulging. The pupil vertical. The nares were laterally placed in a forward position near the rostral.

Endoskeleton.—The formation, size and shape of the skull is on the lines already described for *D. trigonatus* with the following exceptions: —

The parietals end posteriorly in a point slightly overlapped by the supraoccipital crest. The ectopterygoids are slightly broader and jut out laterally on either side of the skull. The maxillary is inclined downwards and not as horizontally positioned as in *D. trigonatus* and the posterior section of it is not as long as in the Deolali species. The articular ramus of the mandible is superiorly definitely winged and notched.

Dentition.—The maxillary is anteriorly set with 12 solid teeth of nearly equal size and length and two anteriorly grooved and recurved fangs posteriorly, as the last in the maxillary series of teeth. The palatines are set with 5 and the pterygoids with 8 solid teeth, all of these are equal in size and length. The dentary has 14 solid teeth; the anterior series are long and recurved and the teeth diminish in size from before backwards.

Vertebrae.—The formation is the same as in *D. trigonatus.*

Ribs.—As in *D. trigonatus.*

Locomotion.—This was not observed.

Habitat.—Western Ghats (Matheran to Travancore) and the Ceylon Hills.

Note :—A lizard of the Gecko type (like the common wall lizard, but darker coloured) was found in the alimentary canal of this specimen.

SUB-FAMILY: COLUBRINÆ *Aglypha*

Species: **Polyodontophis collaris** (Blgr.).

This specimen was received from Barrackpore (Bengal). A description of it has been included in this paper for purposes of comparison in view of the species *Polyodontophis subpunctatus* which belongs to Deolali not having been dealt with on the points of osteology and dentition owing to the bad mutilation of the skull and vertebral column of the only specimen collected.

Exoskeleton.—The formation is of a uniform thickness. The head and body are uniform and show no neck delineation. The snout is obtuse. The body is of uniform thickness decreasing towards the vent. The tail is moderately tapering.

Scale formation.—The scales are retiform and rounded. There is no evidence of keeling. The supralabials number 10; the first and second touch the nasal; the fourth, fifth and sixth touch the eye; and the eighth and ninth the temporal shields. There is one loreal. The sublinguals are in two pairs. The praeoculars and postoculars number two each. The costal scales number 17, 17, 17, rows in the anterior, middle and posterior third of the body respectively. The anal shield is divided into two sections. The subcaudals numbered 109 and were divided throughout. The ventrals numbered 176 and stretched completely across the belly.

This specimen had been bottled in spirit for some time. The colour now described would not be quite an accurate version of the original living specimen. The head showed a sepia tone. There were narrow black striations of a chevron form anteriorly on the head. The nape of the neck showed a broad black collar and posterior to this a frill in white. The anterior two-thirds of the body showed in the cervical region a dark stained area merging behind into a salmon pink. The posterior third of the body was a blackish brown. The belly was white. Along the costal margin there was one dotted line in black on each ventral, which spots ended at the vent. Length:—2 feet 1¼ inches.

The eye was moderately large. The pupil spherical. The nares were placed laterally.

Endoskeleton.—The shape of the skull is oval in the anterior two-thirds of its length. The posterior portion is squared. The intermaxillary is small and placed between the maxillary bones. The nasals are small and shaped like the club of a pack of cards. The frontals are small and show no sutural division. The praefrontals are broadly formed and angled at its corners. The parietals are rounded dorsally and broad, showing no sutural divisions; they are divided from the frontals by a suture. The posterior part of the parietals is rounded off and suturally divided from the occipital segment. The maxillary bones are laterally convexed and in their length slightly inclined downwards and then horizontally backwards; they are thin, long and extend backwards beyond its ectopterygoid articulation. The ectopterygoid is short, thick and arched. The maxillary articular end is broadly and thickly spatulate, posteriorly it thins out; the inner border is convex and laterally on its outer aspect it is concave. The palatines are slender vertical plates. The pterygoid is narrow throughout, but posteriorly slightly broader than the anterior part. It is not grooved ventrally but it touches the mandible. The quadrate is long, superiorly spatulate and shaped like an inverted foot, and inferiorly rod-like and bulbous at the articular termination fitting into the notch of the ramus of the mandible. The squamosals are short, nearly straight and flat plates. The mandible is convex ventrally. The articular ramus is broadly formed and notched; laterally on the outer sides there is a depression and anteriorly justly below the superiorly notched extension is a foramen. The dentary portion shows a specific divergence featured by this section being turned inward at an angle of 120 degrees. In this respect it is quite unlike any other species in Deolali.

Dentition.—There are no grooved or perforated fangs. All the teeth are solid and show a specific character by being peg-topped instead of pointed as in the other species of this family. This species has numerous teeth. The maxillary series number 46 of nearly uniform size and length, those anteriorly set slightly smaller. The palatine and pterygoid teeth show no marked division separating them from each other. Altogether they number 54; the palatine number 12. The dentary has 18 teeth, of which the posterior ones are the larger.

Vertebrae.—The neural spines are short and long in correspondence with the specific formation of the vertebrae which are long antero-posteriorly and short dorso-ventrally. In this respect they differ from the vertebrae of other species in which the diameters are nearly uniform in length. The hypapophyses are well developed in the cervical region and projected backwards more acutely. They diminish gradually in length until in the last vertebra it is reduced to a slight eminence. In the dorsal section there is a complete absence of this process. Except for these differences the vertebrae in this snake conform in formation to the vertebrae of other species.

Locomotion.—This has not been observed.

Gland structure.—A soft white parotid gland. The secretion, as shown by Mme Phisalix and Caius, is toxic to small birds without, however, killing them.

Habitat.—Himalayas, Bengal, Assam, and Burma.

ACKNOWLEDGMENTS.

Apart from the study of the osteological peculiarities made directly from prepared endoskeletons, radiography was utilised as an additional aid. I am therefore very much indebted and grateful to Major J. A. Crawford, R.A.M.C., who was during the period the Senior Medical Officer in this station, for his kindness in not only allowing the use of the X-Ray apparatus of that department attached to the British Military Hospital, but also for editing the manuscript copy of this paper and for the encouragement given. My thanks are due to Messrs. C. P. Coshan and D. J. Nayler, I.M.D. for the skilled aid accorded in securing the radiographs. I have also to thank the following gentlemen for

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EXPLANATION OF LETTERING ON PLATES.

ana,—Anterior neural arch. aps,—Anapophysis. ac,—Acetabulum centrum. ar,—Articular ramus, ar,R,—Articular surface for rib. bo,—Basi-occipital. bs,—Basisphenoid. cr,—Cervical-rib. cor,—Coronoid. c,—Centrum. cv,—Cervical vertebra. ca,—Columella auris. d,—Dentary. eo,—Exoccipital. epg,—Ecto-pterygoid (or transpalatine). ec,—Epiphysis centrum. f,—Frontal. fm.—Foramen magnum. fo, —Fenestra ovalis. fr,—Fenestra rotunda. fvn,—Foramen for 5th nerve. hs,—Hypapophysis. hp,—Hæmal process. im,—Intermaxillary (praemaxilla). irp,—Inferior rib process. lf,—Lachrymal foramen. me,—Mandible. m,—Maxillary. md,—Mastoid. mp,—Metapophysis. ns,—Neural spine. no,a,—Neural arch alae. of,—Optic foramen. oa,—Orbital aperture. odp,—Odontoid process. od,—Odontoid. og,—Orbital groove. pl,—Palatine. pg,—Pterygoid. prf,—Praefrontal. pf.—Postfrontal. pc,—Periotic. przs,—Praezygapophysis. ptzs,—Postzygapophysis. pna,—Posterior neural arch. p.—Parietal. q,—Quadrate (tympanic). rfg,—Reserve fang. s,—Squamosal. sg, or gs,—Gland sulcus. sp.—Sphenoid. so,—Supra-occipital. srp,—Superior rib process. tu,—Turibnal. tp,—Transverse process. t,—Temporal. v,—Vomer.

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FISH OF DEOLALI.

BY

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PART I.

(*With two plates*).

INTRODUCTION AND LIST OF MATERIAL.

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In 1935, the Zoological Survey of India received a small collection of fish from Deolali made by Dr. A. G. L. Fraser at the request of Mr. S. H. Prater. This material comprised seven species, of which two proved to be new to science.[1] As the headwaters of the Godaveri were so far a *terra incognita* for ichthyologists, a request was made to Dr. Fraser through Mr. Prater to make a comprehensive collection of fish at Deolali and its environs. The result has been most satisfactory. Dr. Fraser collected fishes for one year—June 1935 to May 1936—and obtained 4,463 specimens from several localities. The material is in an excellent state of preservation while the ecological factors governing fish life in various types of habitats are vividly described by Dr. Fraser in the descriptions of the localities where the collections were made.

To suit the convenience of the editors of the *Journal,* it is proposed to publish the account of the fish of Deolali in four parts. The first part, as is indicated in the title above, deals with the descriptions of the localities and the material obtained from each locality is listed separately. The second part will contain descriptions of two new species belonging to the genera *Parapsilorhynchus* and *Barbus* and notes on other species. In the third part Dr. A. G. L. Fraser will, in a series of notes, record his observations, both under natural and artificial conditions, on the biology and ecology of the fishes collected by him. In the final part one of us will discuss the geographical relationships of the fish fauna of Deolali, with special reference to its affinities with that of the Deccan.

A complete set of the material, containing type-specimens, is deposited in the collection of the Zoological Survey of India, while a representative series of examples is also preserved in the collections of the Bombay Natural History Society and of the British Museum of Natural History in London.

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[1] Hora, S. L. and Mukerji, D. D.—*Notes on Fishes in the Indian Museum,* xxv. On two new species of Cyprinid Fishes from Deolali, Nasik District, Bombay Presidency. *Rec. Ind. Mus.*, xxxvii, pp. 375-80 (1935).

We take this opportunity to offer our sincerest thanks to Dr. Fraser for the great trouble he must have taken in the collection and preservation of this enormous material, and for his lucid notes regarding the habitats of the various species. We have also to record our indebtedness to Mr. S. H. Prater for his kind interest in the matter and for affording us an opportunity to investigate this interesting material. The Bombay Natural History Society very kindly agreed to our retaining a complete set of the material for the collection of the Zoological Survey of India and further made a grant towards illustrations and other incidental expenses; for all this we are very thankful to the authorities of the Society.

Geographical Location and Physical Features of Deolali.

Dr. Fraser[1] in his account of the snakes of Deolali gives a description of the geographical location, meteorology and physical features of the station but to facilitate reference some of the salient features are reiterated here. Devláli or Deolali is a small military cantonment in the Nasik District of the Bombay Presidency. Deolali is about 4 miles south-east of Nasik and the military cantonment 'is situated about three and a half miles to the south-west, on land formerly included in the villages of Bhagur and Sewnsuri and unconnected with Devláli.'[2]

List Material with Descriptions of Localities.

1. North Nallah pool, 3 miles west of its junction with the Darna river (Dairy Pool). Deolali, 27-6-1935.

The pool is an artificially created one, being formed by a masonry dam and built up stone embankments. It is 40 feet wide and 50 feet long with a depth of from 2 to 5 feet. Its bed is well sanded and its sides in the shallow parts are flagged with stone. It is used for washing cattle belonging to the Military Dairy farm and buffaloes are left to wallow in it for long hours, especially during the hot months of April and May. The pool itself is free from vegetation and its banks are sparsely grown with grass. At this time of the year, owing to the rains, the water in it is muddy and the volume and flow of water over the dam is greater than during the dry weather when it dwindles to a trickle.

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[1] Fraser, A. G. L. 'The Snakes of Deolali'. *Journ. Bom. Nat. Hist. Soc.*, xxxix, pp. 59, 60 (1936).

[2] Cambell, J. M.—*Gazetteer of the Bombay Presidency*, xvi, Nasik, p. 431 (Bombay: 1883).

The height above the mean sea level is from 1,800 to 2,300 ft. The average rainfall is 30 in. The monsoon months are June, July, August and part of September. The hottest months of the year are March, April and May, with the maximum shade temperature between 100 and 110° F. Dry and Wet bulb registrations show a marked humidity during October.

The topography of the country in the environs is undulating in character. On the south side lie the Thal Ghat extensions running east and west. The land is for most part under cultivation, and is intersected by deep tributary 'Nallahs' draining into the river 'Darna', which meanders through east of the Cantonment in a north-easterly direction to a point some 10 miles east of Nasik City, where at 'Darna Sangava' it joins the sacred river Godaveri, (Fraser, *loc. cit.*).

i.	*Barilius bendelisis* Ham.	3 specimens.
ii.	*Rasbora labiosa* Mukerji.	25 specimens.
iii.	*Parapsilorhynchus* (New species)	1 specimen.
iv.	*Nemachilus denisonii* Day.	2 specimens.
v.	*Ophicephalus gachua* Ham.	1 specimen.

2. Section of North Nallah, 1,800 yards from its junction with the Darna river. Deolali, 30-6-1935.

The bed of the Nallah is shelving; and centrally there is a channel about 25 feet wide and from 2 to 3 feet in depth. The sloping banks are covered with varied flora, growing both in the water and on the banks. There is a fair volume of water flowing through this section of the nallah at all times of the year because of the proximity of the Deolali Bazaar, which lies a little to the west on its north bank and the waste water from the Bazaar runs into the nallah.

i.	*Rasbora labiosa* Mukerji	14 specimens.

3. North Nallah, at a point 800 yards west of its junction with the Darna river. Deolali, 4-7-1935.

This part of the nallah is a narrow rocky defile. The banks are high and the sides precipitous, and the channel itself is difficult of access. There is no vegetation in it, but its high banks are grass grown. The depth of the water in this channel was barely 2 feet at the time the fish were taken, but this was just after abatement of the storm water, when the depth must have been at the least 3 feet. The current of the water flowing through it is strong. The sides of the defile, particularly the bases of the banks, are undermined. The rocky bed of the channel itself is eroded and shelved. It is 15 to 20 feet in width. There is also some silt in the bed.

i.	*Chela clupeoides* (Bloch)	1 specimen.
ii.	*Danio aequipinnatus* (McClell.)	3 specimens.
iii.	*Barbus ticto* (Ham.)	3 specimens.
iv.	*Garra mullya* (Sykes)	5 specimens.
v.	*Labeo boggut* (Sykes)	2 specimens.

4. North Nallah, 50 yards west of its junction with the Darna river. Deolali, 14-7-1935.

Here the nallah broadens out and the banks are shelving and slope down to the river. The width of the stream is from 40 to 50 feet. Its depth is about 2 feet at the sides to over 6 feet in the centre. The bed is silted and the flow of water is fairly strong at all times of the year. There is an exuberant growth of vegetation both on the banks and in mid-stream which is full of weeds. Bhil fishermen tell me there are no big fish in this section as it is too open. The few fishes secured by me here are all significantly enough small fry.

i.	*Chela clupeoides* (Bloch)	6 specimens.
ii.	*Rasbora labiosa* Mukerji	1 specimen.
iii.	*Barbus ticto* (Ham.)	1 specimen.
iv.	*Parapsilorhynchus* (New species)	1 specimen.
v.	*Ambassis nama* (Ham.)	3 specimens.
vi.	*Ambassis ranga* (Ham.)	1 specimen.

5. The Waldi river, at a point 2 miles east of its junction with the Darna river up to the village of Chedi; 7-11-1935.

The Waldi river is a tributary of the Darna. The fishes were caught at a point near to the bridge on the Deolali-Nasik road. The village of Deolali is on the north bank, and a few hamlets on the south bank constitute

1. View of section of North Nallah in which *Barilius bendelesis* was found. Bhil name *Jhor*.

2. View of pool in course of North Nallah.

3. Pool between railway bridge in a section of the North Nallah stream.

4. Junction of the North Nallah with Darna River.

a village called Edhgaon. At the time the spot was visited the river was swollen with muddy flood water, turbulently rushing through. It was impracticable to effectively use a net. A spot was selected where it was possible to cast a net from the bank and the fish were really taken from the surface currents. The river here is 50 yards wide and was easily 20 feet deep as a result of the storm waters. The bed in this section is rocky. Owing to the villages in the close proximity the vegetation is scanty and the higher earthy banks are grass-grown. In the dry weather there is less water, but the flow is strong at all times. The river has its origin in the hills at Anjem and Dhammia at an altitude of 4,295 feet above sea level. It is fed from springs at various points along its course and there is a fair volume of water running through at all times of the year. It is roughly 22 miles in extent not taking into account the meanderings. It joins the river Darna one mile west of the village Cheri and about 2 miles east of the village of Deolali.

i.	*Barilius bendelisis* Ham.	46 specimens.
ii.	*Danio fraseri* Hora	11 specimens.
iii.	*Barbus khudree* Sykes	2 specimens.
iv.	*Barbus ticto* (Ham.)	91 specimens.
v.	*Nemachilus botius* (Ham.)	3 specimens.
vi.	*Nemachilus denisonii* Day	1 specimen.
vii.	*Ophicephalus gachua* Ham.	1 specimen.

6. The Darna river, at the ferry point near Bagoor village. Deolali; 25-7-1935.

The fish were caught at a time when the river was swollen with flood water. The banks are grass grown and there are a fair number of gum acacia (*babul*) trees in the near precincts. The width of the river here is 80 to 100 yards (approximate). The depth near the banks is from 2 to 3 feet. Midstream it must be 30 feet. The Darna river is a tributary of the Godaveri and joins it some 10 miles east of Nasik City at a village called Darna Sangava. It has its source in the hills around Igatpuri (Thall Ghats). It is fed from springs and the waters from Lake Beale, which is 3 miles from Aswali Railway Station (G.I.P.R.). This river flows in a north-easterly direction and is one and a half miles east of Deolali Cantonment.

i.	*Notopterus notopterus* (Pallas)	7 specimens.
ii.	*Chela clupeoides* (Bloch)	74 specimens.
iii.	*Chela phulo* (Ham.)	13 specimens.
iv.	*Barilius bendelisis* (Ham.)	21 specimens.
v.	*Danio aequipinnatus* (McClelland)	1 specimen.
vi.	*Rasbora labiosa* Mukerji	2 specimens.
vii.	*Aspidoparia morar* (Ham.)	14 specimens.
viii.	*Barbus khudree* Sykes	3 specimens.
ix.	*Barbus kolus* Sykes	14 specimens.
x.	*Barbus ticto* (Ham.)	28 specimens.
xi.	*Barbus* (new species)	1 specimen.
xii.	*Labeo boggut* (Sykes)	2 specimens.
xiii.	*Rohtee cotio* (Ham.)	6 specimens.
xiv.	*Lepidocephalichthys guntea* (Ham.)	1 specimen.
xv.	*Nemachilus botius* (Ham.)	2 specimens.
xvi.	*Nemachilus denisonii* Day	1 specimen.
xvii.	*Proeutropiichthys taakree* (Sykes)	18 specimens.
xviii.	*Ambassis baculis* (Ham.)	2 specimens.
xix.	*Ambassis nama* (Ham.)	1 specimen.
xx.	*Ambassis ranga* (Ham.)	36 specimens.

7. Swimming pool of Barnes High School, Deolali in the course of Narsullah Wadi, a tributary of the Darna river. Deolali, 28-7-1935.

This channel has the features of the 'North Nallah'. It is fed by springs and during the rains rushes with storm water. In the dry weather the volume and flow are poor. The flora on its banks and in the stream itself is identical with that found in the North Nallah. The channel runs on the southern boundary of Deolali Cantonment and is roughly 2 miles south of it.'

i.	*Barilius bendelisis* Ham.	41 specimens.
ii.	*Danio fraseri* Hora	11 specimens.
iii.	*Rasbora daniconius* (Ham.)	27 specimens.
iv.	*Barbus ticto* (Ham.)	19 specimens.

8. The Darna river, at a point midway between the villages of Sewnsuri and Beladgaon; 8-8-1935.

The river flows nearly due north from Sewnsuri onward past Beladgaon. At the halfway point there is a stretch of about two furlongs extent where the bed widens out and here the river is approximately 80 yards broad. About 35 yards of this width at the side of the west bank is a pebbled beach. The river itself in this section flows in three separate streams of some 10 15 and 20 yards width respectively. In between are some islands which are grown with sedge and tall rushes. These islands appear to be shingle in the form of dried silt and are alluvial in character. The main volume and force of the water are exerted directly on the east bank, where the depth at this season is easily 12 feet or more and in the dry season would be from 8 to 10 feet. The two lesser streams are ankle deep at the sides and knee deep in the middle. The beds of the stream are pebbled and sanded, and in parts rocky. The force and volume of water are good at all times of the year; but the river is more swollen and muddy now due to the rains. The relative height of the banks to the bed is 25 feet. Cultivated fields adjoin the banks. The height above sea level is 1,800 feet.

i.	*Chela clupeoides* (Bloch)	41 specimens.
ii.	*Barilius bendelisis* Ham.	40 specimens.
iii.	*Rasbora daniconius* (Ham.)	1 specimen.
iv.	*Aspidoparia morar* (Ham.)	3 specimens.
v.	*Barbus chola* (Ham.)	3 specimens.
vi.	*Barbus khudree* Sykes	2 specimens.
vii.	*Barbus kolus* Sykes	3 specimens.
viii.	*Barbus ticto* (Ham.)	9 specimens.
ix.	*Barbus* (new species)	2 specimens.
x.	*Rohtee cotio* (Ham.)	1 specimen.
xi.	*Lepidocephalichthys guntea* (Ham.)	1 specimen.
xii.	*Nemachilus botius* (Ham.)	2 specimens.
xiii.	*Callichrous bimaculatus* (Bloch)	1 specimen.
xiv.	*Proeutropiichthys taakree* (Sykes)	2 specimens.
xv.	*Ophicephalus marulius* Ham.	1 specimen.

9. The Waldi river, near the village of Pimpalgaon Khamb; 17-8-1935.

The Waldi river flows from west to east. The heights of the banks in relation to the bed of the river are approximately fifty feet. The depth in the section explored is roughly from one foot on the south bank to 8 feet midstream and 12 feet at the river's edge directly against the north bank, where the main volume and force of the water are exerted. The width here is 50 to 60 feet. The volume and flow of water are full and strong at all times of the year, but at the time of the visit the river was moderately swollen with muddy storm waters. The bed is also rocky and sanded and silted in parts. In this particular section it is free from vegetation. The opposite bank is precipitous and for a little more than half its height consists of basalt rock. The rounded and irregular earthy strata on the top fifty feet above are covered with grass and heavily wooded with 'babul' and 'mango' trees. The height above sea level is 1,900 feet.

i.	*Barilius bendelisis* Ham.	2 specimens.
ii.	*Danio aequipinnatus* (McClell.)	1 specimen.
iii.	*Rasbora daniconius* (Ham.)	1 specimen.
iv.	*Barbus khudree* Sykes	45 specimens.

1. View of section of the Narsullah wadi running through Barnes High School.

2. Rocky section of lower stretch of Narsullah wadi near village of Bagoor.

3. Darna River near Goti Railway Station (G. I. P.).

4. Stretch of Darna River halfway between villages of Swensuri and Beladgaon.

v.	*Barbus kolus* Sykes	1 specimen.
vi.	*Barbus ticto* (Ham.)	67 specimens.
vii.	*Garra mullya* (Sykes)	1 specimen.
viii.	*Nemachilus botius* (Ham.)	3 specimens.
ix.	*Ophicephalus gachua* Ham.	2 specimens.

10. Lower section of Narsullah Wadi, near the village of Bagoor; 25-8-1935.

Here the stream broadens out and flows over a rocky bed before reaching a broad cutting between earthy banks. The width of the channel in this section is some 30 yards. The north bank maintains a relative height of 30 feet above the water line of the stream, even at its junction with the Darna and continues in an easterly direction as the north bank of the Darna, which in this locality flows due east. The south bank of the Narsullah Wadi slopes down from a height of 20 feet and ends flush with the north-west bank of the Darna as the latter at the point of junction has a bend in the course, deflecting it to the east. The depth of the section explored is from 2 feet at the sides to 8 feet midstream. The bed of the stream here is silted up. The upper and higher reach is rocky. The banks are grass-grown and the edges of the stream are fringed with rushes and some weeds. The volume of water is full and strong at all times of the year. At this season the stream is moderately swollen with muddy flood water.

i.	*Barilius bendelisis* Ham.	17 specimens.
ii.	*Danio aequipinnatus* (McClell.)	11 specimens.
iii.	*Rasbora daniconius* (Ham.)	1 specimen.
iv.	*Rasbora labiosa* Mukerji	31 specimens.
v.	*Barbus ticto* (Ham.)	222 specimens.
vi.	*Garra mullya* (Sykes)	12 specimens.
vii.	*Parapsilorhynchus* (New species)	7 specimens.
viii.	*Lepidocephalichthys guntea* (Ham.)	1 specimen.
ix.	*Nemachilus denisonii* Day	1 specimen.
x.	*Ophicephalus gachua* Ham.	5 specimens.

11. Pool of a tributary 'Nallah' of the Darna river, near the 110th mile of the railway track on the Deolali to Igatpuri line; 29-8-1935.

The actual site of the pool in this 'Nallah' is some 200 yards from the railway bridge. This pool has been naturally formed by the stream running into a natural depression in the ground. Practically the whole of this is rock and the outfall has been bunded up by a natural dam of rock over which the water falls and continues its course in an easterly direction to join the Darna. The relative height of the banks which are rock overlaid by an earthy stratum is about 25 feet. The bed of the pool is silted up over its rocky base. The width of the pool is 20 feet and its length is roughly 70 feet. The depth of water is from 2 to 3½ feet. The earthy stratum is grown with grasses and the highland in the vicinity is given over to cultivation. The height above the sea level near this point is 1,852 feet. The total extent of this tributary nallah is roughly 2½ miles. It takes its origin from springs which are located about half a mile or more due west of the railway bridge and flows all the year though the volume is very poor during the dry months. At this season it is flowing strongly with muddy storm water drainage.

i.	*Barilius bendelisis* Ham.	3 specimens.
ii.	*Rasbora daniconius* (Ham.)	1 specimen.

12. The Darna river, near to the village of Sewnsuri; 8-9-1935.

The part explored was from the west bank against the village of 'Sewnsuri'. The greater part of this bank is rocky and shelving. The village is superimposed and built upon the part rocky base and part earthy layer which uprises from the shelving riverside, and is roughly 40 feet above the river.

A road from the village leads down to the river and opens directly on to the very wide and shelving rocky plinth. The village population is about 1,000. The inhabitants use the river for all purposes. Their cattle are also bathed in the river. A local industry of preparing raw hides is carried on in this village. The fresh skins are scraped and cleaned at the river side and then dried. The scrapings from the hides pollute the river and the portion of the bank where the work is done is therefore very insanitary. The shelving plinth is free from vegetation and is roughly 80 yards long and 30 yards or more broad. In the south corner of the plinth is a small temple with a shrine, the base of which is just over the water line. The villagers throw food stuff into the river and feed the fish. They do not object to fishes being caught; they invite you even on the temple site and in a friendly spirit show you the likely spots where big fish are to be had. The width of the river is about 40 feet and the depth is from 3 to 4 feet on the west bank, from 4 to 5 feet midstream and one foot on the east bank where there is a sanded beach. The opposite bank is from 10 to 15 feet high and is grown with grasses and bordered with fields under cultivation. The bed of the river on the side of the west bank is practically all rock. Midstream it is sanded and silted. The volume of water is good at all times of the year. Now the river is moderately swollen and muddy with storm water. The height above the sea level is approximatey 1,820 feet.

i.	*Chela clupeoides* (Bloch)	1 specimen.
ii.	*Barilius bendelisis* Ham.	6 specimens.
iii.	*Rasbora daniconius* (Ham.)	1 specimen.
iv.	*Barbus chola* (Ham.)	1 specimen.
v.	*Barbus kolus* Skyes	1 specimen.
vi.	*Barbus ticto* (Ham.)	123 specimens.
vii.	*Barbus* (new species)	4 specimens.
viii.	*Lepidocephalichthys guntea* (Ham.)	10 specimens.
ix.	*Nemachilus botius* (Ham.)	11 specimens.
x.	*Nemachilus denisonii* Day	13 specimens.
xi.	*Heteropneustes fossilis* (Bloch)	2 specimens.
xii.	*Mystus cavasius* (Ham.)	1 specimen.
xiii.	*Ophicephalus gachua* Ham.	6 specimens.
xiv.	*Ophicephalus marulius* Ham.	2 specimens.
xv.	*Ambassis ranga* (Ham.)	1 specimen.
xvi.	*Glossogobius giuris* (Ham.)	1 specimen.

13. Middle section of the Narsullah Wadi meandering through the Barnes High School Estate; 12-9-1935.

For the description of the locality see No. 10.

i.	*Barilius bendelisis* Ham.	9 specimens.
ii.	*Danio aequipinnatus* (McClell.)	23 specimens.
iii.	*Rasbora labiosa* Mukerji	112 specimens.
iv.	*Garra mullya* (Sykes)	13 specimens.
v.	*Parapsilorhynchus* (new species)	18 specimens.
vi.	*Lepidocephalichthys guntea* (Ham.)	32 specimens.
vii.	*Nemachilus denisonii* Day	60 specimens.
viii.	*Nemachilus evezardi* Day	4 specimens.

14. Pool at the source of the Narsullah Wadi; 12-9-1935.

The upper section of the 'Narsullah Wadi' courses down through narrow shallow channels from 4 to 5 feet wide and is barely ankle deep except in the two or three pools in its whole extent where the water is knee deep. It is fed from a series of three springs which issue and originate at the bases of two tors, the chief one of which is named 'Siva Donghai', 2,527 feet above the sea level. This region is a stony waste except in certain parts which are sparsely grown with grass. For roughly a mile in this section the bed of the stream is rocky and sanded. Thereafter the terrain becomes earthy black soil and the banks are bordered with fields under cultivation. At this season 'bajri' and 'groundnut' are in evidence. The fishes in this batch were taken from a rocky pool fed from the three springs in its close vicinity at the foot of the tors. The banks are in part earthy and are grown with grasses and the flora usually found on the banks of rivers and streams in this area. The pool is 12 by 10 feet wide and knee deep. The bed is rocky. The altitude of the pool would be roughly 2,100 feet above sea level.

i.	*Rasbora daniconius* (Ham.)	7 specimens.
ii.	*Parapsilorhynchus* (new species)	37 specimens.
iii.	*Lepidocephalichthys guntea* (Ham.)	1 specimen.
iv.	*Nemachilus evezardi* Day	22 specimens.

15. Quarry Tank, at the end of Dhondy Road, Deolali Cantonment; 19-9-1935.

These fishes were taken from a quarry accumulation of water brought about by blasting operations carried out sometime in the past. As a result of these operations either a spring or some sub-soil source of water supply has been tapped and the ooze from below has made the area into a permanently filled tank. Obviously because of its potentialities for breeding mosquitoes this tank has been stocked with fish. No information is available as to when the tank became thus artificially formed; nor is the year known when the fishes were put into it. At present the water in it is not used for any purpose and is left neglected except for the regular visits paid to it by the Anti-Malarial Squad who examine it for the presence of mosquito larvae. These however appear not to be able to thrive in it owing to the presence of the fishes. The water accumulation as it now exists presents the form of nearly a square about 40 by 50 feet. Its depth would be about 25 feet from the surface of the banks. The depth of the water is well over 12 feet. It consists of practically solid basalt rock save for the earthy strata upon the banks. At the south end a section of the bank slopes down to the water edge and has a base of rock overlaid by a surface layer of earth. The rest of the bank is steeply upright from the surface of the water and is grass-grown. The water in it is dirty looking with a scum and algae floating on its surface. It is now teeming with a new species of *Rasbora* which do not appear to have suffered by the change in environment from that of a running stream to a still water tank. The nearest stream is the 'North Nallah' which is three furlongs distant from this tank. I mention this fact in order to support the statement that the tank must have been stocked with this species, as there is no connection between it and the North Nalla unless it be a subterranean one. I have failed to discover any other species in it.

i.	*Rasbora labiosa* Mukerji	74 specimens.

16. The Aounda river, west of the road bridge between Aswali Railway Station and Lake Beale; 29-9-1935.

The road bridge mentioned is one mile and a furlong from Lake Beale and the 'Aounda' river courses under it and meanders on due east until it joins the river 'Darna' below the dam. The 'Aounda' river has its origin in the heights south of 'Anjem'. These heights are the southerly ranges extending in an easterly direction towards 'Ambli' at an average height of 4,000 feet above the sea level. The springs and the drainage from the northern face of these heights help to swell the 'Waldi' river, while those on the southern aspects feed the river 'Aounda', flowing from it in a southerly direction until it meets the 'Kharki' nallah some ten miles south of its origin. About four miles north above the point of junction with the 'Kharki' nallah, near to a village called 'Raju' the 'Aounda' is joined by two other tributary nallahs, namely, the 'Choni' and 'Kohki' nallahs, all of which flow south and are perennial streams adding to its volume. The river 'Aounda', in its extent, is roughly 25 miles in all up to its junction with the river 'Darna'. From the junction with the 'Kharki' nallah the course is irregular. It flows south-east for a mile or so and then turns north for 3 to 4 miles, after which it meanders in a south-easterly direction and finally due east up to the junction with the 'Darna'. In the stretch explored, west of the road bridge referred to, the river flows from west to east. Here are the remains of a former road bridge which at some remote period must have been washed away by a flood, as there are breaches in its length and the masonry bases of the piles supporting the former structure are now submerged. The existing masonry remains uprise from the river banks on either side to a height of ten feet. These show evidence of considerable erosion. West of this ruined bridge is a large expanse of water about one hundred yards long and 60 feet broad with a varying depth of 2 feet at the sides to 4 feet midstream. The fishes in this batch were taken from this section. The north bank is earthy and grown with vegetation and heavily wooded with *'babul'* (gum acacia). The relative height of this bank to the bed of the river is about 25 feet. The south bank in its total extent is shelved with basalt rock sloping to the river's edge. Above this rocky plinth there is an earthy stratum rising to a height varying from 15 to 20 feet. This bank is bordered by fields under cultivation. The bed of the river is rocky and sanded for the greater portion of its width except for the shallows of the north bank which is silted up. The river was moderately swollen with muddy storm water at the time of the visit. The volume and flow were full and strong in midstream. The altitude is roughly 1,800 feet above sea level.

i.	*Chela clupeoides* (Bloch)	2 specimens.
ii.	*Barilius bendelisis* Ham.	1 specimen.
iii.	*Rasbora daniconius* (Ham.)	2 specimens.
iv.	*Barbus amphibius* (C. & V.)	1 specimen.
v.	*Barbus chrysopoma* C. & V.	1 specimen.
vi.	*Barbus kolus* Sykes	1 specimen.
vii.	*Barbus ticto* (Ham.)	1 specimen.
viii.	*Garra mullya* (Sykes)	6 specimens.
ix.	*Labeo calbasu* (Ham.)	1 specimen.
x.	*Labeo porcellus* (Heckel)	5 specimens.
xi.	*Mystus cavasius* (Ham.)	1 specimen.
xii.	*Ambassia ranga* (Ham.)	1 specimen.
xiii.	*Glossogobius giuris* (Ham.)	3 specimens.

17. The Aounda river, $\frac{1}{4}$ mile west of Lake Beale Dam; 6-10-1935.

The stretch of water is some 120 yards long and of a uniform width of nearly 60 feet. The river in this section flows in a slightly north-easterly direction. The depth is from 2 feet at the sides to roughly 6 feet midstream. There is a good volume of water flowing through with a strong centrally running current. The water was slightly turbid with mud. The south-east bank is in part an earth embankment 12 to 18 feet high and is grown with long grass and a few *'babul'* trees. It is bordered with cultivated fields. The continuity of this bank then gives place to rocky plinths which slope to the water edge and in parts are precipitous up to a height of 5 to 10 feet. The opposite bank is for the whole length of this section a sanded beach 40 feet wide; and more inland to this it is earthy and grown with grasses and heavily wooded with acacia (*babul*). The bed of the river on the side of the north-west bank is sanded and the south-east bank is silted up in parts and where the rocky plinth begins it is composed of rock and sand. Midstream it is silted. There are no villages in this locality. The altitude above the sea level is 1,800 feet.

i.	*Labeo porcellus* (Heckel)	1 specimen.
ii.	*Mystus cavasius* (Ham.)	4 specimens.

18. Pool at the head of a nallah draining into the Aounda river; 6-10-1935.

The length of this 'Nallah' stream is not more than two furlongs and the spring and the pool formed by it are just below the road running from Lake Beale Dam to 'Aswali' railway station (G.I.P.R.). The stream begins here and in its course is of a varying width but never more than 8 feet in its broadest section. It is ankle deep in some parts and in other sections barely a few inches. The bed of the 'Nallah' has a steep gradient and is practically rock throughout its whole length except near to its junction with the 'Aounda' river. It runs through cultivated fields of '*bajri*'. The height of the pool above the river Aounda is at least 50 feet. The volume and flow are poor. The bed of the pool is rock and its depth is 2 feet. The width and breadth is 10 by 12 feet.

i.	*Danio aequipinnatus* (McClell.)	1 specimen.
ii.	*Rasbora daniconius* (Ham.)	27 specimens.
iii.	*Barbus amphibius* (C. & V.)	18 specimens.

19. Section of the Aounda river, 5 miles west of Lake Beale Dam; 15-10-1935.

The river here bends from under the railway track, which is bridged over, and curving northward reaches after a 5 furlongs run the site from which the fish were collected. The direction of the river at this point is due north. The volume of the water was great and at the time of the visit the river was swollen with muddy storm waters, with the force of the current directed against the west bank. The east bank is a pebbled stretch of a length of 40 and a breadth of 20 feet. From this beach to a height of 10 feet is an earth embankment overgrown with grass and bordered by fields under cultivation (*bajri* crop). The opposite bank is all shelving rock. In the high sections of this rocky base are some sparsely grown patches of grass. The bed of the river is pebbled throughout. The depth of the water is from 2 feet at the sides to 4 feet midstream. The largest fish in this batch weighing when caught 1 lb. and 2 oz. was taken near the edge of the west bank. Here the bed is rocky and sanded, but at the water's edge there was a growth of rushes, which was localised to a small patch where there is a gathering of silt.

i.	*Barilius bendelisis* Ham.	2 specimens.
ii.	*Rasbora daniconius* (Ham.)	2 specimens.
iii.	*Barbus khudree* Sykes	1 specimen.
iv.	*Barbus kolus* Sykes	1 specimen.
v.	*Barbus melanostigma* Day	3 specimens.
vi.	*Barbus pinnauratus* Day	4 specimens.
vii.	*Barbus ticto* (Ham.)	1 specimen.
viii.	*Garra mullya* (Sykes)	3 specimens.
ix.	*Labeo boggut* (Sykes)	2 specimens.
x.	*Nangra viridescens* (Ham.)	2 specimens.
xi.	*Glossogobius giuris* (Ham.)	1 specimen.

20. & **21.** West side sloping rocky channel which conducts the released waters from Lake Beale *via* the Dam directly into the river Darna at the point of its junction with the Aounda river; 15-10-1935.

Lake Beale, (named after the Engineer who built the dam) is 17 miles long and 2 miles broad in its widest section. The dam was built across the course of the river 'Darna' in 1912 and converted a large area of the depression through which the 'Darna' river originally coursed into a lake. The dam is about one mile in extent and on an average 40 feet in height. The depth of water in the lake against the dam is from 8 to 10 feet. From the dam the waters rush over a wide and steep rocky bed interspersed with large boulders of basalt rock and become divided into two streams; one on the west side and the other on the east side of the wide rocky bed. The fishes were caught in the west channel which is 30 feet wide and about 2 furlongs in extent. Owing to the steep gradient of the rocky bed the waters swirl down in a roaring torrent. When there is an increased volume of water flowing through this channel from the lake it is dangerous for a man to negotiate a passage through it. Bhil fishermen however manage to do so only at a certain point, where a section of this channel, about midway in its length, levels out for 10 feet or more and here in this patch the fishermen cast their nets regularly every evening with the certainty of securing fishes of large size weighing up to 3 lb. The gates of the dam are opened regularly during the monsoon months and occasionally during the dry months and at the time of the visit the water flowing through the channel was in great volume owing to some of the gates on the west side of the dam having been opened. In the level patch referred to above, the depth of the water depends upon the volume rushing through it. It may be knee deep or at its greatest height about 3 feet or more. At the end of the 2 furlongs run the channels below the dam, which constitute the river 'Darna', are joined by the river 'Aounda' and this junction creates a wide expanse of water seething and foaming with swirling currents rushing over beds of pure rock without evidence of any vegetation on its banks. The altitude of the dam is 1,875 feet and the levels of the junction of the two rivers would be 1,800 feet.

i.	*Chela clupeoides* (Bloch)	10 specimens.
ii.	*Barbus khudree* Sykes	1 specimen.
iii.	*Barbus kolus* Sykes	3 specimens.
iv.	*Barbus sarana* (Ham.)	2 specimens.
v.	*Wallago attu* (Bloch)	1 specimen.
vi.	*Ambassis ranga* (Ham.)	5 specimens.
vii.	*Glossogobius giuris* (Ham.)	3 specimens.

22. The Darna river at its junction with the Aounda river at the point where the rocky channel conducting waters from Lake Beale levels out with the Darna river; 20-10-1935.

The wide expanse of waters at the junction of the two rivers mentioned is roughly 120 yards broad and about 2 furlongs in extent. It is an area composed mostly of rock. The north bank is in part a sanded beach giving place to sloping rocks and interspersed with large boulders. The river 'Aounda' section is less agitated by the currents and becomes turbulent when joined by the furious waters from the 'Darna' river channels which conduct the released waters from Lake Beale. The average depth is 3 feet but midstream in the wide expanse it is from 6 to 8 feet in certain parts. There is no vegetation on the banks.

i.	*Chela clupeoides* (Bloch)	6 specimens.
ii.	*Chela phulo* (Ham.)	3 specimens.
iii.	*Rasbora daniconius* (Ham.)	1 specimen.
iv.	*Barbus amphibius* (C. & V.)	7 specimens.
v.	*Barbus pinnauratus* Day	1 specimen.
vi.	*Barbus sarana* (Ham.)	2 specimens.
vii.	*Crossochilus latius* (Ham.)	1 specimen.
viii.	*Garra mullya* (Sykes)	2 specimens.
ix.	*Labeo porcellus* (Heckel)	2 specimens.
x.	*Rohtee duvaucelii* (C. & V.)	1 specimen.
xi.	*Mystus cavasius* (Ham.)	2 specimens.
xii.	*Ambassis nama* (Ham.)	4 specimens.
xiii.	*Ambassis ranga* (Ham.)	104 specimens.
xiv.	*Glossogobius giuris* (Ham.)	5 specimens.

23. The Godaveri river, 1 mile east of the Indore road bridge east of Nasik city; 29-10-1935.

The river in this section flows due east, and it is moderately swollen with storm waters and the force of the current is directed against the north bank owing to a slight bend in the run. The north bank rises 25 feet above the water level and it is composed of a rocky base of about 10 feet with an earthy layer of 15 feet above. The south bank is on an average 20 feet above a sanded beach which is 30 yards broad. The width of the river is roughly 110 feet. I am told that when the river is in flood the expanse of the river is then 200 feet and nearly reaches the top of both the north and south banks. At the time of the visit the waters had receded and the sanded beach referred to above had become exposed. The land in the precints of both the banks is grown with fruit orchards—grape vineyards, guava, plantains, and citrons. On the banks there are many tamarind and *babul* trees. The bed of the river is pebbled and silted up. The depth is on an average 2 feet on the south bank edges, midstream it must be 3 to 4 feet and 6 feet towards the north bank edge. The height above sea level is 1,300 feet.

i.	*Chela clupeoides* (Bloch)	13 specimens.
ii.	*Chela phulo* (Ham.)	8 specimens.
iii.	*Barilius bendelisis* Ham.	7 specimens.
iv.	*Danio aequipinnatus* (McClell.)	4 specimens.
v.	*Rasbora daniconius* (Ham.)	3 specimens.
vi.	*Barbus khudree* Sykes	7 specimens.
vii.	*Barbus kolus* Sykes	2 specimens.
viii.	*Barbus ticto* (Ham.)	5 specimens.
ix.	*Crossochilus latius* (Ham.)	2 specimens.
x.	*Garra mullya* (Sykes)	16 specimens.
xi.	*Labeo boggut* (Sykes)	1 specimen.
xii.	*Rohtee cotio* (Ham.)	1 specimen.
xiii.	*Nemachilus botius* (Ham.)	1 specimen.
xiv.	*Nemachilus evezardi* Day.	15 specimens.
xv.	*Glyptothorax lunah* (Sykes)	1 specimen.
xvi.	*Ophicephalus gachua* Ham.	1 specimen.
xvii.	*Ambassis ranga* (Ham.)	1 specimen.
xviii.	*Glossogobius giuris* (Ham.)	9 specimens.

24. North Nallah stream, from pools below the Deolali Cantonment Bazaar; 31-10-1935.

For description, see the account of locality No. 1.

i.	*Barilius bendelisis* Ham.	105 specimens.
ii.	*Rasbora labiosa* Mukerji	27 specimens.
iii.	*Barbus ticto* (Ham.)	2 specimens.
iv.	*Garra mullya* (Sykes)	2 specimens.
v.	*Lepidocephalichthys guntea* (Ham.)	19 specimens.
vi.	*Nemachilus denisonii* Day	1 specimen.
vii.	*Nemachilus evezardi* Day	2 specimens.

25. Middle section of the Narsullah Wadi running through Barnes High School estate; 1-11-1935.

For description, see the account of locality No. 10.

i.	*Rasbora labiosa* Mukerji	118 specimens.
ii.	*Barbus ticto* (Ham.)	3 specimens.
iii.	*Garra mullya* (Sykes)	1 specimen.
iv.	*Lepidocephalichthys guntea* (Ham.)	17 specimens.

26. Section of the Darna river at its junction with the Waldi river up to the village of Chedi; 7-11-1935.

The river has subsided but still flows with very strong currents which are particularly forceful near the bridge. The depth of the run is on an average, midstream, about 3 feet with shallows of one foot at the sides. The force of the current is against the south bank. Both the banks are earthy and shelving down to sandy beaches about 30 feet wide on either side. The north bank leading down from the village of Chedi has a more extensive pebbled beach (approximately 30 yards), which during the rains is submerged but is now dry. The bed of the river is pebbled throughout and in parts is silted up.

i.	*Chela clupeoides* (Bloch)	1 specimen.
ii.	*Barilius bendelisis* Ham.	6 specimens.
iii.	*Rasbora labiosa* Mukerji	1 specimen.
iv.	*Barbus khudree* Sykes	1 specimen.
v.	*Barbus sarana* (Ham.)	1 specimen.
vi.	*Barbus ticto* (Ham.)	16 specimens.
vii.	*Garra mullya* (Sykes)	2 specimens.

viii.	*Nemachilus botius* (Ham.)	4 specimens.
ix.	*Ambassis ranga* (Ham.)	6 specimens.
x.	*Glossogobius giuris* (Ham.)	3 specimens.

27. The Waldi river near the villages of Deolali and Edhgaon; 14-11-1935.

The Waldi river here flows from west to east and the villages of Edhgaon and Deolali lie on the south and north bank respectively. The banks and the bed of the river are composed of basalt rock throughout. The flow and volume of water in the river are strong and good. The depth is from 2 feet at the sides to 3 feet midstream. The width is from 40 to 50 feet. The height above sea level is about 1,850 feet. The height of the banks from the bed of the river is about 30 feet.

i.	*Barilius bendelisis* Ham.	25 specimens.
ii.	*Danio aequipinnatus* (McClell.)	2 specimens.
iii.	*Barbus khudree* Sykes	3 specimens.
iv.	*Barbus ticto* (Ham.)	11 specimens.
v.	*Garra mullya* (Sykes)	41 specimens.
vi.	*Nemachilus botius* (Ham.)	2 specimens.

28. The Godaveri river, one mile east of the Indore Road Bridge east of Nasik city; 8-12-1935.

Since the last visit (*vide* locality No. 22) the river has considerably subsided and the pebbled beach is exposed and is covered with a layer of silt. This beach inclines down from the south bank to the water's edge and in extent would be 150 feet broad and 100 yards or more in length. The force of the very sluggish flow is against the north bank and there is a large amount of green algae in evidence, fragments are seen floating in the surface scum and the water generally is very filthy looking and ashen in colour. The depth of the water in its deepest part against the north bank is 3½ feet and in the shallows of the edge against the south beach it is barely a foot in depth. The beach referred to above is being ploughed up and in parts of it cucumber and water melons seeds are being sown. All the specimens of the species *Barbus ticto*—Bhil name 'Tiptoo'—taken on this day in this section of the river showed a scarlet pigmentation of the body scales and the caudal and dorsal fins were similarly stained. They have lost this colouration in spirits.

i.	*Barilius bendelisis* Ham.	3 specimens.
ii.	*Garra mullya* (Sykes)	1 specimen.
iii.	*Barbus khudree* Sykes	7 specimens.
iv.	*Barbus kolus* Sykes	5 specimens.
v.	*Barbus ticto* (Ham.)	27 specimens.

29. Pool in the course of the North Nallah; 14-12-1935.

This pool is a small one about 30 by 40 feet and from 2 to 3 feet in depth. The bed is all rocky and so are the banks on either side. There is no vegetation in the locality. It is roughly one mile and a half from the junction of the 'North Nallah' with the Darna river. It is 1,830 feet above sea level.

i.	*Barilius bendelisis* Ham.	9 specimens.
ii.	*Danio aequipinnatus* (McClell.)	26 specimens.
iii.	*Rasbora daniconius* (Ham.)	5 specimens.
iv.	*Barbus ticto* (Ham.)	141 specimens.
v.	*Garra mullya* (Sykes)	1 specimen.
vi.	*Lepidocephalichthys guntea* (Ham.)	2 specimens.

30. The Darna river, 1 mile from Ghote Railway Station, 26-12-1935.

Here the river Darna is about 50 yards wide. The current is strong midstream and the relative heights of the banks above the water's level are 10 to 15 feet. The banks are grown with the usual and varied flora. The bed of the river is silted up and appears to be earthy. The depth midstream is about 6 feet and 2 feet at the sides. The height above sea level is roughly 1,950 feet.

i.	*Chela clupeoides* (Bloch)	1 specimen.
ii.	*Barbus amphibius* (C. & V.)	13 specimens.
iii.	*Barbus sarana* (Ham.)	2 specimens.
iv.	*Barbus ticto* (Ham.)	3 specimens.
v.	*Lepidocephalichthys guntea* (Ham.)	3 specimens.
vi.	*Ambassis ranga* (Ham.)	7 specimens.

31. The Darna river, one furlong from Ghote Railway Station; 28-12-1935.

Here the river is about 60 yards wide and curves northwards parallel with the railway track. It is about a furlong from the Railway Station. The banks are rocky in the greater part of this section and the bed at the river edge is composed of rocky plinths, parts of which are silted. The current is strong midstream and the depth must be at least eight feet. At the edge of the river on the west bank the depth is from 2 to 3 feet and it suddenly deepens towards the middle. The height above sea level would be about 1,900 feet.

i.	*Chela clupeoides* (Bloch)	3 specimens.
ii	*Danio aequipinnatus* (McClell.)	6 specimens.
iii.	*Rasbora daniconius* (Ham.)	8 specimens.
iv.	*Barbus amphibius* (C. & V.)	8 specimens.
v.	*Barbus pinnauratus* Day	1 specimen.
vi.	*Barbus ticto* (Ham.)	18 specimens.
vii.	*Garra mullya* (Sykes)	122 specimens.
viii.	*Rohtee duvaucelii* (C. & V.)	1 specimen.
ix.	*Nemachilus botius* (Ham.)	3 specimens.
x.	*Mystus cavasius* (Ham.)	22 specimens.
xi.	*Ophicephalus gachua* Ham.	2 specimens.
xii.	*Ambassis ranga* (Ham.)	9 specimens.

32. Section of the North Nallah which runs by Deolali Cantonment Bazaar; 2-1-1936.

All these fishes were caught in a section of the 'North Nallah' which runs by the Deolali Cantonment Bazaar. Here the water is strongly alkaline to litmus paper. The depth of water in the stream is from ½ to 2 feet and the bed is silted over a rocky base. There is much washing of clothes done at this point and the water is soapy and foul smelling as it tends to stagnate owing to a sluggish surface flow. In the silt, particularly at the edges of the stream, worms can be found at all times of the year. It was observed that *Barilius bendelisis* partly buried themselves in the silt in order to hide and escape our efforts to catch them and it was found easier to simply lift the silt and then pick out the fishes buried in it. It was then also discovered that worms were present in the silt.

i.	*Barilius bendelisis* Ham.	64 specimens.

33. Lower section of Narsullah Wadi, near to Bagoor village; 8-1-1936.

For description, see account of locality No. 10.

i.	*Barilius bendelisis* Ham.	6 specimens.
ii.	*Danio aequipinnatus* (McClell.)	5 specimens.
iii.	*Rasbora daniconius* (Ham.)	7 specimens.
iv.	*Aspidoparia morar* (Ham.)	1 specimen.
v.	*Barbus khudree* Sykes	2 specimens.
vi.	*Barbus ticto* (Ham.)	33 specimens.
vii.	*Garra mullya* (Sykes)	4 specimens.
viii.	*Nemachilus botius* (Ham.)	1 specimen.
ix.	*Ophicephalus gachua* Ham.	6 specimens.

34. Pool in the course of the North Nallah; 10-1-1936.

For description, see account of locality No. 28.

i.	*Barilius bendelisis* Ham.	3 specimens.
ii.	*Danio aequipinnatus* (McClell.)	2 specimens.
iii.	*Rasbora labiosa* Mukerji	13 specimens.
iv.	*Barbus ticto* (Ham.)	12 specimens.
v.	*Lepidocephalichthys guntea* (Ham.)	1 specimen.
vi.	*Nemachilus denisonii* Day	1 specimen.
vii.	*Nemachilus evezardi* Day	8 specimens.

35. One furlong run above the 10 feet Dam in the middle section of the Narsullah Wadi; 19-1-1936.

For description, see account of locality No. 10.

i.	*Barilius bendelisis* Ham.	2 specimens.
ii.	*Danio aequipinnatus* (McClell.)	1 specimen.
iii.	*Rasbora daniconius* (Ham.)	21 specimens.
iv.	*Rasbora labiosa* Mukerji	9 specimens.
v.	*Barbus ticto* (Ham.)	75 specimens.
vi.	*Garra mullya* (Sykes)	11 specimens.
vii.	*Parapsilorhynchus* (New species)	19 specimens.
viii.	*Lepidocephalichthys guntea* (Ham.)	3 specimens.
ix.	*Nemachilus evezardi* Day	4 specimens.
x.	*Ophicephalus gachua* Ham.	1 specimen.

36. The Darna river, near the village of Sewnsuri; 30-1-1936.

For description, see account of locality No. 12.

i.	*Barilius bendelisis* Ham.	6 specimens.
ii.	*Rasbora daniconius* (Ham.)	1 specimen.
iii.	*Barbus khudree* Sykes	8 specimens.
iv.	*Barbus kolus* Sykes	1 specimen.
v.	*Barbus ticto* (Ham.)	28 specimens.
vi.	*Garra mullya* (Sykes)	11 specimens.
vii.	*Labeo porcellus* (Heckel)	1 specimen.
viii.	*Nemachilus botius* (Ham.)	2 specimens.
ix.	*Glossogobius giuris* (Ham.)	1 specimen.

37. The Darna river, near the village Sewnsuri; 30-1-1936.

The fish were caught at the sides of the river in a portion of it which was but a few inches deep and where there was no current. The bed was a silt-covered sanded section and water was strongly alkaline to litmus paper while the temperature of the water in this particular spot at 3 p.m. was 86 degrees F. All of these specimens appear to be very young examples of *Barilius bendelisis*. Bhil name—'Jhor'.

i.	*Barilius bendelisis* Ham.	21 specimens.

38. The Darna river, in the run south of Lahavit Railway Station; 4-2-1936.

The width of the river here is some 60 feet. The river flows from south-west to north-east. The banks are earthy and the height above the water level is 3 feet. The south bank is bordered with fields under cultivation while the north bank is wooded with *Babul* trees. The bed of the river is silted up over an earthy base and it is rankly overgrown with water weeds which at the edges of the river are 4 feet in length. The depth midstream must be 12 feet and at the edges 5 feet. The stretch itself is a straight run of about 2½ furlongs length and the current is particularly strong midstream. The height above sea level is 1,820 feet.

i.	*Notopterus notopterus* (Pallas)	2 specimens.
ii.	*Mastacembelus armatus* (Lacép.)	1 specimen.

iii.	*Anguilla anguilla* (Ham.)	1 specimen.
iv.	*Danio aequipinnatus* (McClell.)	1 specimen.
v.	*Rasbora daniconius* (Ham.)	4 specimens.
vi.	*Barbus kolus* Sykes	1 specimen.
vii.	*Barbus sarana* (Ham.)	2 specimens.
viii.	*Cirrhina reba* (Ham.)	1 specimen.
ix.	*Labeo boggut* (Sykes)	3 specimens.
x.	*Labeo porcellus* (Heckel)	1 specimen.
xi.	*Ophicephalus leucopunctatus* Sykes	1 specimen.

39. Pool in the course of North Nallah, below the Deolali Cantonment bazaar; 10-2-1936.

For description, see the account of locality No. 1.

i.	*Barilius bendelisis* Ham.	89 specimens.
ii.	*Danio aequipinnatus* (McClell.)	1 specimen.
iii.	*Rasbora labiosa* Mukerji	70 specimens.
iv.	*Barbus ticto* (Ham.)	1 specimen.
v.	*Garra mullya* (Sykes)	2 specimens.
vi.	*Lepidocephalichthys guntea* (Ham.)	4 specimens.
vii.	*Nemachilus denisonii* Day	2 specimens.

40. East channel, below Lake Beale Dam; 24-2-1936.

The east channel courses down at a steep gradient but midway there is a section of the run which levels out for about 50 yards and here there is a good growth of the usual flora on the banks and the area is wooded with *Babul* trees. This stretch was explored at a time when the sluice gates were open and the channel was rushing and roaring with the torrents. The bed here is composed of rock throughout and the depth varies from 2 to 4 feet. The volume and force of the current was full and very strong. The width of the channel is from 6 feet to 40 feet in the level area. The total length of the channel from the sluice gates to where the waters once again level out at a point some 200 yards below the junction of the west channel with the Aounda river is roughly 3 furlongs. The gradient is less steep than that of the west channel and the whole of it is practically rock throughout. The distance between the west and east channels corresponds to the length of Lake Beale Dam itself. In between are some small rills and collections of water which are of no importance and the whole of the area consists of basalt rock plinths and boulders of large size.

For other particulars see the notes connected with locality No. 20.

i.	*Chela phulo* (Ham.)	7 specimens.
ii.	*Rasbora daniconius* (Ham.)	8 specimens.
iii.	*Barbus amphibius* (C. & V.)	1 specimen.
iv.	*Barbus khudree* Sykes	2 specimens.
v.	*Barbus kolus* Sykes	1 specimen.
vi.	*Barbus ticto* (Ham.)	7 specimens.
vii.	*Cirrhina reba* (Ham.)	16 specimens.
viii.	*Garra mullya* (Sykes)	7 specimens.
ix.	*Labeo boggut* (Sykes)	5 specimens.
x.	*Lepidocephalichthys guntea* (Ham.)	1 specimen.
xi.	*Nemachilus botius* (Ham.)	1 specimen.
xii.	*Callichrous bimaculatus* (Bloch)	3 specimens.
xiii.	*Mystus cavasius* (Ham.)	1 specimen.
xiv.	*Ophicephalus gachua* Ham.	1 specimen.
xv.	*Ophicephalus marulius* Ham.	1 specimen.
xvi.	*Ambassis baculis* (Ham.)	2 specimens.
xvii.	*Ambassis nama* (Ham.)	6 specimens.
xviii.	*Ambassis ranga* (Ham.)	24 specimens.
xix.	*Glossogobius giuris* (Ham.)	37 specimens.

41. The Darna river, between the village of Sewnsuri and Deladgaon; 7-3-1936.

On the day of the visit there was only one main stream and this flowed directly by the east bank. The current was strong and full but with a less volume of water. The width was also slightly less.

i.	*Chela clupeoides* (Bloch)	11 specimens.
ii.	*Barilius bendelisis* Ham.	97 specimens.
iii.	*Rasbora daniconius* (Ham.)	2 specimens.
iv.	*Aspidoparia morar* (Ham.)	24 specimens.
v.	*Barbus khudree* Sykes	45 specimens.
vi.	*Barbus kolus* Sykes	5 specimens.
vii.	*Barbus sarana* (Ham.)	2 specimens.
viii.	*Barbus ticto* (Ham.)	3 specimens.
ix.	*Crossochilus latius* (Ham.)	3 specimens.
x.	*Garra mullya* (Sykes)	93 specimens.
xi.	*Labeo boggut* (Sykes)	28 specimens.

42. The Darna river between the villages of Sewnsuri and Beladgaon; 18-3-1936.

For description, see account of locality No. 8.

i.	*Chela phulo* (Ham.)	6 specimens.
ii.	*Barilius bendelisis* Ham.	8 specimens.
iii.	*Danio aequipinnatus* (McClell.)	8 specimens.
iv.	*Rasbora daniconius* (Ham.)	1 specimen.
v.	*Aspidoparia morar* (Ham.)	2 specimens.
vi.	*Barbus khudree* Sykes	6 specimens.
vii.	*Barbus sarana* (Ham.)	2 specimens.
viii.	*Garra mullya* (Sykes)	19 specimens.
ix.	*Labeo boggut* (Sykes)	8 specimens.

43. Pool in the course of the North Nallah; 29-3-1936.

For description, see account of locality No. 29.

i.	*Barilius bendelisis* Ham.	23 specimens.
ii.	*Danio aequipinnatus* (McClell.)	2 specimens.
iii.	*Barbus ticto* (Ham.)	12 specimens.

44. Pool in the course of the North Nallah; 15-4-1936.

For description, see account of locality No. 29.

i.	*Barilius bendelisis* Ham.	5 specimens.
ii.	*Rasbora daniconius* (Ham.)	1 specimen.
iii.	*Barbus ticto* (Ham.)	126 specimens.
iv.	*Garra mullya* (Sykes)	4 specimens.

45. Pool in the course of the North Nallah; 20-5-1936.

For description, see account of locality No. 29.

i.	*Barilius bendelisis* Ham.	19 specimens.
ii.	*Rasbora labiosa* Mukerji	31 specimens.
iii.	*Garra mullya* (Sykes)	10 specimens.
iv.	*Lepidocephalichthys guntea* (Ham.)	1 specimen.

46. The Darna river, near Lahavit; 28-4-1936.

For description, see account of locality No. 38.

i.	*Barilius bendelisis* Ham.	1 specimen.
ii.	*Barbus khudree* Sykes	1 specimen.
iii.	*Barbus kolus* Sykes	6 specimens.
iv.	*Barbus parrah* (Day)	1 specimen.
v.	*Labeo porcellus* (Heckel)	5 specimens.
vi.	*Rohtee vigorsii* Sykes	3 specimens.
vii.	*Wallago attu* (Bloch)	1 specimen.
viii.	*Mystus cavasius* (Ham.)	5 specimens.

47. The Darna river, between the village of Sewnsuri and Beladgaon; 29-4-1936.

For description, see account of locality No. 8.

i.	*Barilius bendelisis* Ham.	3 specimens.
ii.	*Barbus khudree* Sykes	3 specimens.
iii.	*Barbus kolus* Sykes	19 specimens.
iv.	*Barbus melanostigma* Day	1 specimen.
v.	*Barbus sarana* (Ham.)	3 specimens.
vi.	*Garra mullya* (Sykes)	1 specimen.
vii.	*Labeo porcellus* (Heckel).	4 specimens.
viii.	*Glossogobius giuris* (Ham.)	1 specimen.

48. The Darna river, near Lahavit Railway Station; 3-5-1936.

For description, see account of locality No. 38.

i.	*Barbus khudree* Sykes	3 specimens.
ii.	*Barbus kolus* Sykes	4 specimens.
iii.	*Barbus sarana* (Ham.)	1 specimen.
iv.	*Labeo porcellus* (Heckel).	3 specimens.
v.	*Glossogobius giuris* (Ham.)	1 specimen.

49. The Darna river, near Lahavit Railway Station; 10-5-1936.

For description, see account of locality No. 38.

i.	*Chela clupeoides* (Bloch)	2 specimens.
ii.	*Barbus kolus* Sykes	8 specimens.
iii.	*Barbus sarana* (Ham.)	1 specimen.
iv.	*Labeo porcellus* (Heckel)	3 specimens.
v.	*Rohtee vigorsii* Sykes	1 specimen.
vi.	*Mystus cavasius* (Ham.)	22 specimens.

50. Section of the North Nallah, below the Deolali Cantonment bazaar; 20-5-1936.

On this date this section of the 'North Nallah' contained a small amount of water confined to a channel which was 5 feet in width and was eight inches deep. There was no flow and the continuity of the channel had dried up below it for about 40 yards. The water was stagnant and foul smelling and strongly alkaline to litmus paper and the temperature of the water at 2 p.m. was 96° F.

i.	*Barilius bendelisis* Ham.	74 specimens.
ii.	*Rasbora labiosa* Mukerji	2 specimens.
iii.	*Parapsilorhynchus* (new species)	1 specimen.

THE BIRDS OF BOMBAY AND SALSETTE.

BY

SÁLIM ALI and HUMAYUN ABDULALI.

PART II.

(*With three plates*).

(*Continued from page* 103 *of this volume*).

The Pied Bush-Chat : *Saxicola caprata atrata* Blyth.

Field identification : Size about that of a Sparrow. The male is jet black with white patches on the shoulders, particularly conspicuous in flight. The abdomen and base of tail both above and below are also white. The female is a soberly coloured brown bird with a patch of rusty reddish at the base of tail above, especially noticeable when on the wing. Frequents bare stony and sparse scrub country in the neighbourhood of cultivation and habitations.

Specimens : Khandala birds examined by Whistler vide *J.B.N.H.S.*, xxxviii, p. 284.

EHA, both in *The Common Birds of Bombay* and in *Nests & Eggs* (ii, 42) says that the Pied Bush-chat is to be found 'across the Harbour' and that it 'retires to the hills to breed'. Though not actually observed in Salsette, S. A. has a record of a pair seen on the out-skirts of a babool jungle near Kihim, on 17th September.

The *atrata* form is a common resident in the Ghats but as a bird seen at Nandur-Madhmeshwar, Niphad (Nāsik) during Christmas 1933 was almost certainly of the *bicolor* form, it is probable that the low country records for the cold weather refer largely to this northern migratory race.

Breeding : It breeds commonly in the Ghats from April to early June at Khandala, Panchgani and in the neighbouring country. We have also observed pairs at Arthur Hill Lake (Bhandardara) near Ghoti in May.

The nest is the usual pad of grass, hair, etc. placed under a stone or in a hoof-hole, in open or sparsely wooded country. Both parents assist in feeding the young. During the breeding season the male has a pretty song of several notes.

The Indian Stone-Chat : *Saxicola torquata indica* (Blyth).

Field identification : Size same as last—about that of a Sparrow. Males have a black head and a conspicuous white collar. The breast is reddish-brown and there is a white shoulder patch as in the foregoing. The female is plain brown and not unlike the female of the Pied Bush-chat except that it lacks the red patch at base of tail. Frequents cultivation and out-skirts, and open sparsely scrubbed country.

Specimens : *B.N.H.S.* ♀ ? 30-1-21 Santa Cruz (B.C.E.) ; ♂ 5-2-24 Andhēri (S.H.P.) ; ♂ 25-1-13 Santa Crùz (N.B.K.) *St. X. C.* : 157 Andhēri 7-11-33 ; 234 Andhēri 22-3-35 (H.A.).

This is a fairly common winter visitor—the two specimens 157 (7 November) and 234 (22 March) being our extreme dates—frequenting open uncultivated areas in the low country. Its habits are not unlike those of the Pied Bush-chat except that it appears to prefer a stone to a bush as a look-out post. Across the harbour it is also commonly met with while snipe-shooting as it does not appear to mind the wet, provided there is a sufficiency of sea-holly, or bunds to keep its feet dry. Sp. 157 collected in open waste land had fed on small beetles, and the general habitat of the bird leads one to believe that these must comprise a considerable proportion of its diet.

Breeding : Br. Navarro of St. Xavier's College, to whom we are indebted for many specimens and valuable information from Khandala and elsewhere, reports this bird as nesting at Khandala. He has procured the eggs, but in the absence of breeding specimens this will have to be confirmed.

The Wheatear : *Œnanthe deserti atrogularis* Blyth.

Field identification : Size slightly larger than that of a Sparrow. A pale sandy coloured bird with black wings and tail. Chin, throat and foreneck also black. A white shoulder patch and the pale whitish rump very conspicuous in flight. Female duller and brownish where male black. Inhabits open barren waste land with stones and sparse stunted thorn bushes.

Specimens : *B.N.H.S.* : 27-2-24 Pāli Hill, Bandra (S.A.) ; ♂ 12-11-12, ♂ 14-2-13 Santa Cruz (N.B.K.). *St. Xavier's Col.* : 21 Andhēri 3-1-33 ; 163 Andhēri 10-11-33 (H.A.).

In spite of the statement in the *New Fauna* to the effect that this bird is a winter visitor to the plains of North-West India only, it appears to be a sparse but regular visitor to our area. 12 November and 27 February are our earliest and latest dates. It frequents the same type of country as the last species, but does not venture into marshy land. It is also more terrestrial than the stone-chat, running on the ground for longer distances, and not returning as regularly to a favoured perch. Wheatears are active little birds ; they wag their tails in the manner of wagtails. As a rule they are silent, but we have heard a male utter a loud 'cht-tt-tt'.

The Redstart : *Phœnicurus ochruros* subsp.

Field identification : Size about that of a Sparrow. Male black with orange-chestnut underparts from breast downwards. Tail and rump also this colour, particularly conspicuous in flight. Female plain brown with underparts and tail similar to but paler than in male. The tail is constantly shivered. Frequents open stony country and mango orchards.

Specimens : *B.N.H.S.* : 21-1-24 Andhēri (S.H.P.).

This is another regular winter visitor to our area though not occurring in any large numbers. Our earliest record is on 10 October and last on 15 March. At Panchgani, in the Ghats, the birds were extremely common as late as 26 March 1934. It frequents rocky, scrub-covered hillsides and broken country. It is also occasionally found in mango groves and such shady places where there is no under-growth.

Redstarts are seldom quiet. The body is continually dipped jerkily, and the tail flirted for no apparent reason, showing the flash of chestnut-red that gives them their name. Though redstarts find their food on the ground, they habitually fly into trees in the manner of tree-pipits when disturbed.

The Bluethroat : *Cyanosylvia suecica pallidogularis* Sarudny.

Field identification : Size somewhat smaller than that of a Sparrow. A pale brown bird with the appearance and bearing of the Indian Robin. Just before it leaves us in the hot weather the male acquires a blue throat. The tail and rump are orange chestnut and particularly conspicuous in flight. Inhabits the neighbourhood of swamps and well irrigated fields.

Specimens : *B.N.H.S.* : ♀ 26-12-1900 (EHA). *St. Xavier's Col.* : 222 January Andhēri.

Noted : Santa Cruz, Gōdhbunder, Powāi Lake, Rewās, etc.

This bird, a fairly common winter visitor to our area, is unlikely to be seen except by those who are optimistic enough to pursue snipe in the neighbourhood of Bombay. A terrific skulker, it revels in the security of dense growths of sea-holly (*Acanthus*), in salt and brackish marshes by tidal creeks, and in the coarse Polygonon and Cyperaceae that border fresh water pools and streams.

The earliest bird was noted by us on 15 November ; the last on 5 March.

[The Rubythroat : *Calliope calliope* Pallas.

This is an East-Asiatic form that winters in eastern India, and also occasionally in Central India (*J.B.N.H.S.*, xxxvi, p.72). The only record from our area is that of Jerdon who mentions a specimen that 'took refuge on board ship a little south of Bombay'.]

The Indian Robin : *Saxicoloides fulicata ptymatura* (Vieillot).

Local name : *Kala dumnat.*

Field identification : Size about that of a Sparrow. Male shiny black with white patches on the shoulders, often visible only in flight. A bright chestnut patch under the tail conspicuous on account of the bird's habit of holding its tail erect or cocked-up. Female dark brown with no white wing patches but with a paler chestnut patch under the tail. Usually pairs in open country near villages and cultivation.

Specimens : *B.N.H.S.* Several ; *St. X. C.* 29. Andhēri 3-8-33 (H.A.).

Resident. This is one of the most familiar birds of the low country, frequenting cultivated fields, fallow land in the vicinity of villages, scrub jungle and scrub-covered hills, quarries, ruins, and similar places. It is a tame and confiding bird, usually found in pairs, busily occupied in picking up insects from the ground. They occasionally perch on bushes but are essentially of terrestrial habits.

Breeding : The breeding season is from the end of March to the middle of June, the birds possibly being double-brooded. 2 or 3 eggs are laid in nests which are placed in holes, in cuttings, earth-banks, under stones, and in the roots of up-turned palmyra palms. In our area we have never come across a nest in a hollow tree-trunk or anywhere above ground-level, as so commonly seen elsewhere. A larger or smaller piece of snake-slough, is invariably included in the make-up of a nest. One nest examined was composed entirely of human hair. The birds build in the same locality year after year, but resent observation and will desert a nest if the least interest is shown in it.

The Magpie Robin : *Copsychus saularis saulfaris* Linn.

Local name : *Dominga ; Dhyal.*

Field identification : Size about that of a Bulbul. Back, head and breast black, wings and tail parti-coloured black and white, lower plumage white. In the female the black of the male is replaced by brown or ashy-brown. A familiar black-and-white songster usually seen with the tail cocked-up as in the Robin. Frequents gardens and the neighbourhood of habitations.

Specimens : *B.N.H.S.* Several from suburbs. *St. X. C.* : 5 Gōrēgāon 19-8-33 (H.A.).

Resident. This is another common bird of the low country, found in gardens and orchards, and in general replaces the last species where there are more trees than scrub. It is often found in heavy forest, and though a tree-dweller picks a considerable portion of its food off the ground. We have seen it eating snails and earth-worms. This last item is of interest as we have read somewhere that earth-worms are immune from the attacks of birds. This is one of our finest songsters and it is also an excellent mimic. We have for instance heard it imitate a 'did-he-do-it' to perfection.

Breeding : The males start singing from exposed perches about the middle of February, and the breeding season extends from March (Barnes) to June. The nest, a mere pad of fine twigs or leaf-stalks is placed in rafters, wells, hollow pipes, tree-stumps, wood-pecker holes, and holes in rotten palms. The usual clutch is of 5 eggs though occasionally only three are laid. The laying season coincides to some extent with the onset of the monsoon, and many nests are flooded out. The same site is used year after year.

On 7-5-30 H. A. found a nest in a date palm, containing the remains of a newly-hatched chick, which had apparently been killed and eaten by large black ants (*Camponotus* sp.). The birds laid again in the same nest and on the 20th there were 5 eggs.

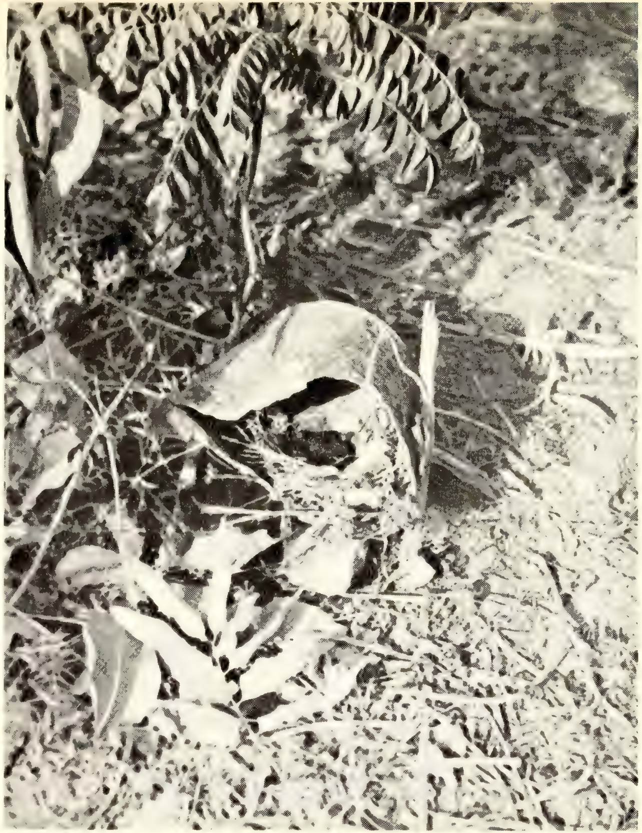
The Indian Shama : *Kittacincla malabarica malabarica* (Scopoli).

Field identification : Size about that of a Bulbul. A black bird with a longish black-and-white tail and a white patch at the base of it above. Lower plumage from breast downwards bright chestnut. In the female the black is replaced by slaty-brown and the lower parts are considerably paler. A beautiful songster frequenting thick jungle, and more often heard than seen.

Specimens : *B.N.H.S.* juv. 9-9-28 (S. A.).

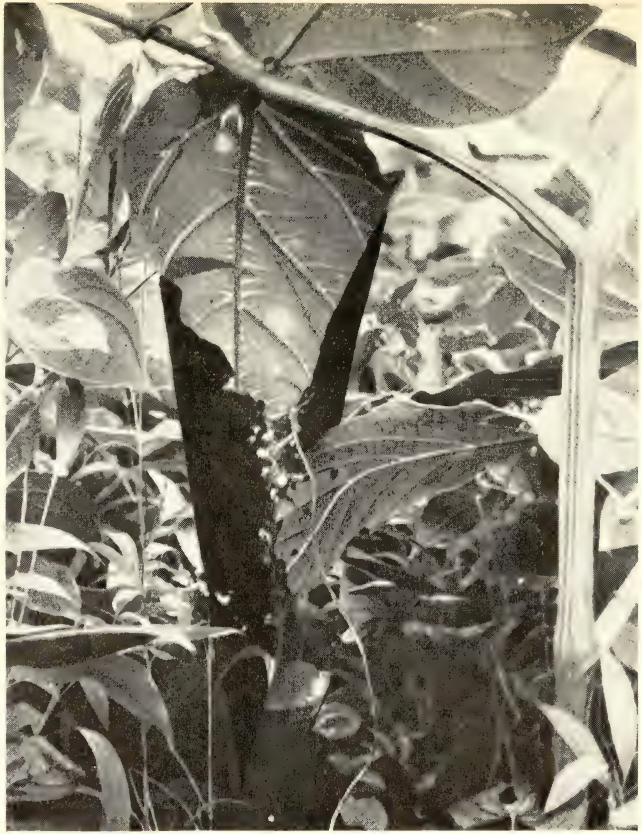
Noted : Karnala ; Kankēshwar ; Gōdhbunder.

This handsome bird, presumably a resident, is by no means common in our area. It keeps to the heavily forested portions of Salsette and the neighbouring Ghat country, frequenting dense under-growth, where it is not easily seen,



Photos

Nest and chicks of the Indian Robin (*Saxicoloides fulicata*) in a derelict tin.



Sálim Ali

Nest of the Tailor Bird (*Orthotomus sutorius*) in leaf of monsoon plant, almost touching ground.

Breeding: Our only record is a juvenile bird collected by S.A. on the Thāna-Gōdhbunder Road on 9 September 1928.

The Black-capped Blackbird : *Turdus simillimus mahrattensis* Whistler.

Field identification: Size of a Myna. A plain greyish-brown thrush with a black cap. The female is duller and has the cap less pronounced. The bill is pale orange and conspicuous. Singly in wooded country; on the ground or in trees.

Specimens: *B.N.H.S.*: 10-3-24 Pāli Hill; 21-3-24 Chembūr (S.A.)

Noted: Andhēri, Powāi, Bandra, Kihim, Uran, Rōha.

The Black-capped Blackbird wanders into our area from the Ghats during the non-breeding season i.e. from October to March. It is one of the regular habitués at the parties that gather on the blossoms of *Erythrina* and *Bombax*, and as such is commonest in the deciduous forest that covers the hillsides round Tūlsi Lake and farther north. Stray birds, are however not uncommonly met with in the low country, at Andhēri and Bandra. The song is not unlike a dhyal's but louder and richer. It is also an excellent mimic, with an exceptionally fine rendering of the plaintive cuckoo. It takes its food both on the ground and among the trees. On the ground it may be seen hopping about busily turning over dead leaves in the usual thrush-manner, in search of grubs and caterpillars. The stomach of a specimen contained the young petals and pollen grains of *Erythrina stricta*. Small parties may also be seen picking up the figs of the banyan, and during the cold weather they have been observed feeding largely on the berries of *Lantana camara* (Kihim). The fruit of the Jāmun (*Eugenia jambolana*) is largely eaten.

Breeding: It does not breed in our area except possibly on Tungar Hill, just across Bassein Creek, where the bird was common in evergreen patches in early April. In the Ghats, at Khandala, Panchgani, etc., it breeds in great numbers during the rains (June to August).

The White-throated Ground Thrush: *Geokichla citrina cyanotus* (Jardine and Selby).

Field identification: Size of a Myna. Orange-chestnut bird with bluish grey wings and tail which in the female are more brownish-olive. A white patch on the quills conspicuous in flight. Usually singly and shy in and about overgrown nullahs etc. in forest.

Specimens: *B.N.H.S.*: ♀ 6-6-06 Kalyan (J. Brand) ♂ 25-3-29 Tūlsi Lake (S.A.); ♂ *St. X. C.*: 12 Gōrēgāon 7-8-33 (H.A.).

Noted: Powāi, Borivli, Chembūr, etc.

This is another of the shy forest birds of our area which though not really rare are seldom seen except by those who leave the road and venture into the more remote regions. It is, as its name suggests, mainly a ground-haunting species, being found where there are plenty of leaves to turn over, and the degree of moistness necessary for a sufficiency of worms and insects. It also feeds on berries.

Breeding: Br. Navarro took a nest with c/4 at Powāi on 28 July, in a fork in a *Bridelia* tree about 10 feet from the ground. The nest is a rather shallow cup-shaped structure—reminiscent of a babbler's nest—of twigs, roots, etc. and for a thrush, with a very small quantity of mud used in its construction. On 20 June a bird was flushed off an empty nest on the Thāna-Gōdhbunder Road. It breeds commonly at Khandalla during the rains.

The Blue-headed Rock Thrush: *Monticola cinclorhyncha* (Vigors).

Field identification: Size of a Myna. 'Male easily recognized by the blue head and throat, chestnut rump and lower plumage and white patch in the wings; female brown with a scaled appearance and a rather conspicuous dark eye' (*Whistler*).

Specimens: *B.N.H.S.*: ♂ 25-3-29 Tūlsi Lake. (S.A).

Noted: Powāi; Khandala; Matheran (Sparrow Coll.); Panchgani (Fr. Blatter); Poona, Mahābleshwar (Butler).

This Rock-thrush appears to be a rare passage migrant in Salsette, our only records being the specimen and another noted on 23 February. On the adjoining Ghats, however, it appears to be commoner both as a passage migrant and as a regular winter visitant.

The Blue Rock Thrush : *Monticola solitaria pandoo* (Sykes).

Field identification: Size between Myna and Bulbul. A uniform leaden blue bird with brown wings. Female duller and brownish. Seen solitary on boulders and about quarries, etc.

Specimen: *St. X. Col.*: 220 Andhēri January 1935 (H.A.).

Noted: *Bombay*: Warden Road, St. Xavier's College Compound, B.B. & C.I. Loco shed at Parel; *Adjacent Mainland*: Karnala; Alibāg.

A fairly common winter visitor to our area, usually found singly on rocky hillsides, and occasionally in the low country, from about the middle of October to April. S.A. records one as a frequent visitor to a bird-bath in the Collector's garden at Alibāg in March 1930. Aitken noticed it on rocks on the sea-shore. It has a habit of sitting bolt upright on the bridge of a roof, or cornice or some similar situation, and occasionally bowing and flirting its tail.

At Karnala it was observed eating the figs of a species of *Ficus*. It has also been observed making aerial sallies after insects in the manner of a flycatcher.

The Malabar Whistling Thrush : *Myophonus horsfieldii* Vigors.

Local Name: *Gogi* (Marathi).

Field identification: Size between Myna and House Crow. Deep blue-black plumage glistening in certain lights. Forehead and shoulders bright cobalt blue. Sexes alike. Singly or pairs on rocky hill streams.

No specimen collected.

Noted: Kaneri Caves, Shendur, Trombay Hill; Apsoli (Alibāg); Pārsik.

Apparently much persecuted, both for its beautiful plumage, and for its young which have a ready demand as cage birds. A few pairs still manage to survive in the hills and jungle in the immediate vicinity of the Kaneri Caves, and in the northernmost parts of Salsette. We have also noted and heard it among the water-courses in the Trombay Hills during the rains. It is common among the hills across the creek, north of Salsette, and in the Ghats at Khandala and Panchgani. Its loud, rich, wandering whistle, startlingly human, has earned it the name of the Whistling School-boy. Others call it the 'Byculla loafer'. In the remoter hills, north of our area, round Wada and Suriamal, there is hardly a hill-stream that has not its pair of Whistling School-boys, and there is no doubt that if the general practice of taking the young of this bird were put a stop to, they would soon become more numerous in Salsette.

It is usually observed either singly or in pairs. Like other members of this and allied families it constantly jerks its tail and spreads it fanwise. It has been suggested that this habit has developed among birds inhabiting wet and slippery rocks, to help them in maintaining their balance on precarious footholds. Having observed this apparently superfluous movement of the tail (or wing) in widely differing forms, we are inclined to suggest that its true purpose is to dislodge lurking insects. The School-boy has also been noticed swallowing entire drupes of *Jasminum malabaricum* from a shrub over-hanging a rocky nullah. A stone was seen to be disgorged later.

Breeding: The Whistling Thrush breeds at the Kaneri Caves, where H. A. has found several old nests and seen them building on 30 June 1935. Across the harbour, he has found a disused nest at Apsoli. At Khandala and Panchgani they breed commonly from early June to late September. The nest is a large cup-shaped structure of mud, held together with rootlets and moss. There is also usually a slight lining of moss. It is most often placed in a niche in a rock either by the side of or overhanging a running hill-stream, the rock to which the nest is attached being often wet with spray. A favourite site at Khandala is inside the numerous tunnels through which the pipe-lines run. The nest is then in entire darkness. The same nest is built upon year after year, growing in size until considerable dimensions are achieved. At Panchgani, S.A. discovered several nests down wells. The period of incubation is 16 days. The usual clutch is of 4 eggs.

The Red-breasted Flycatcher : *Siphia parva* subsp.

Field identification: Smaller than a Sparrow. A plain brown fly-catcher with a black and white tail. The tail is often jerked up or held robin-wise with wings drooping on either side. The sexes are alike but in summer the throat and breast of the male become orange-chestnut. Seen singly in mango orchards, etc.

Specimens: *B.N.H.S.*: ♂ 15-1-24 Andhēri (S.H.P.); ♂ 16-2-24 Pāli Hill (S.A.).

Noted: Bandra, Chembūr, Thāna.

This pretty bird appears to be a scarce but regular winter visitor to the mango orchards and such other shady places in our district. It makes short sallies after insects, and sometimes also hovers before a flower or sprig in search of them. Occasionally one may hop on to the ground from an over-hanging perch, and with a couple of jerks of its cocked tail, snap up an insect near the ground and flit back to its perch. It is in regular attendance at the flowers of *Bombax malabaricum*, for the insects that crowd to the nectar.

Tickell's Blue Flycatcher: *Muscicapula tickelliæ tickelliæ* (Blyth).

Field identification: Somewhat smaller than the Sparrow. 'A dark blue bird with the throat and breast reddish and the rest of the lower parts white. No white line over the eye' (*Whistler*). The female is duller all round. Usually singly, in scrub and secondly jungle.

Specimens: *B.N.H.S.*: ♂ 7-6-25 Trombay Hill (S.A.); ♂ 16-1-24 Andhēri (S.H.P.) *St. X. Col.*: 19 Powāi 17-11-32 (H.A.).

Noted: Malabār Hill, Chembūr, Gōdhbunder, Andhēri, Kihim, Karnala, etc.

This cheery little bird is common in the better wooded and forested parts of the island from October to May. While it is certain that some at least remain in our area during the monsoon, it is obvious that the majority go away to breed. We have no record of a nest in our area; the nearest is from Poona where Betham took nests in August (*J.B.N.H.S.*, xii, 78).

The Verditer Flycatcher: *Eumyias thalassina thalassina* (Swainson).

Field identification: Size of a Sparrow. Male bluish-green, female duller.

Specimens: The British Museum has the following specimens:

2 ♂♂ 1-11-75 Matheran (Hume Coll.); ♀ 4-2-72 Matheran (Capt. Lloyd): ♂ 15-2-18 Khandala (Gosse).

There is one in the St. X. Col. Collection obtained at Khandala in November.

Noted: Karnala; Shendur (Salsette); Kihim.

This is probably a regular winter visitor or passage migrant to the more remote and secluded valleys in our island. At Shendur, on 3-1-35, several birds were seen, and at Karnala on 16-2-36 it was quite common in a forest association comprised of *Hypothymis*, *Tchitrea*, *Ægithina*, various *Phylloscopi*, and *Chaptia*. Like all the smaller flycatchers, it has the habit of sitting bolt upright and remaining in that position for some time.

The Indian Brown Flycatcher: *Alseonax latirostris* (Raffles).

Field identification: Somewhat smaller than Sparrow. Similar in appearance to female of Red-breasted Flycatcher, but distinguishable from it by absence of white in tail feathers. Solitary, in wooded country.

Specimens: *St. Xavier's College*: 140, 142 Kihim 23-10-33; 188 Bombay 23-3-34.

Noted: Andhēri, Marōl, Borivli, Trombay Hills, etc.

Common on passage during October and again in March. A few are winter visitors. It frequents gardens and mango groves and open deciduous forest. In habits it is very like the last species.

The Paradise Flycatcher: *Tchitrea paradisi paradisi* (L.)

Field identification: Size about that of a Bulbul. The adult male snow white with 2 long ribbons in tail and metallic black head. Female and young male chestnut brown above, without tail ribbons, with black head and greyish-white underparts. Singly or pairs in gardens and light deciduous forest.

Specimens: *B.N.H.S.* ♂ 1-2-26 Malād (E. Henricks); ♂♀ 27-1-29 Chembūr; ♂ 3-3-29 Tūlsi Lake (S.A.); *St. X. Col.* 181 Powāi 9-3-33.

Noted: Andhēri, Khandala, Kihim, Kankēshwar, Panchgani, Gōdhbunder.

A common winter visitor from about the middle of October to early May. Some also on passage. This delightful bird is a frequenter of shady groves and gardens and over-grown nullahs, and is also met with in all the well-wooded parts of Salsette, though nowhere in great numbers. Its graceful and agile movements—especially those of an adult male, with its ribbons trailing in the air as it makes the usual flycatcher sallies after insects—are particularly fascinating to watch. In spite of the striking colours of the adult male it is remarkable how inconspicuous the bird can become when sitting motionless with the sunlight falling in patches through the foliage.

Breeding : We have no record of its breeding in our area though it may possibly do so in the Ghats about Khandala.

The Black-naped Blue Flycatcher : *Hypothymis azurea styani* (Hartlaub).

Field identification : Size about that of a Sparrow. Male, a brilliant blue with whitish underparts. A black patch on hind crown and a black crescent on throat. Female browner with a dull bluish wash confined to head and neck. Flits about among foliage of trees in forest, and often erects and opens tail fanwise.

Specimens : *B.N.H.S.* ♀ 28-11-27 Mulund (S.A.) ; ♂ Malabār Hill (P. M. D. Sanderson) ; *St. X. Coll.* 141 Kihim 21-10-33 (H.A.).

Noted : Chembūr, Andhēri, Borivli, Gōdhbunder, Pawāi Lake, Tungar Hill, Karnala, Rōha.

Common in the cold weather ; and a few remain behind to breed. This bird inhabits the same type of country as the Paradise Flycatcher and where one is found the other may be confidently looked for. Its voice and notes when flitting about or launching sallies after insects bear a close resemblance to some of those uttered by *Leptocoma asiatica* and *Æthopyga vigorsi,* a sort of harsh interrogative 'chi-whi?'

Breeding : On 8-5-35 a pair was discovered building in the tiny fork of a mango 30 feet from the ground in a garden at Kihim. The nest was, however, deserted owing no doubt to the unwelcome attention of crows. Br. Navarro took a c/3 at Khandala in June.

The White-spotted Fantail Flycatcher : *Leucocirca pectoralis pectoralis* Jerdon.

Local name : *Nāchan.*

Field identification : Size about that of a Sparrow. Active sprightly blackish brown bird, spotted white about the breast and with a white eyebrow. The tail is spread fanwise and held erect.

Specimens : *St. Xavier's College* : 182 Andhēri 30-3-34 (H.A.).

A pair or two of these Flycatchers will be found in every garden both in the city and the suburbs. Even in the lesser inhabited parts of the island it occurs wherever there are shady open glades such as mango topes. They feed largely on the little Jassid hoppers that are so abundant on the bark of mango trees.

Within the forest itself it is less common than *Muscicapula tickelliæ* or *Hypothymis.* It is occasionally met with in mangroves by creeks etc.

Breeding : The nesting season lasts from March to August. Nests may be found wherever the birds occur : in gardens in the suburbs as well as those in the heart of the city. Lime and chikoo trees are especially favoured as nesting sites. The nest is a neat cup of fibres about 2 inches across, plastered over with cobwebs. It is very similar to an Iora's in appearance, but whereas the Iora's is rounded off at the bottom the Flycatcher's invariably has a bunch of strips hanging untidily underneath. It is usually placed 5 to 10 feet above the ground. The eggs almost invariably number three. The owners are bold in defence of their nests and furiously attack crows and other birds, even cats and human beings, intruding into their proximity.

In spite of this, however, the mortality in eggs and young is enormous, Crows, Crow-pheasants and Bloodsucker lizards being mainly responsible.

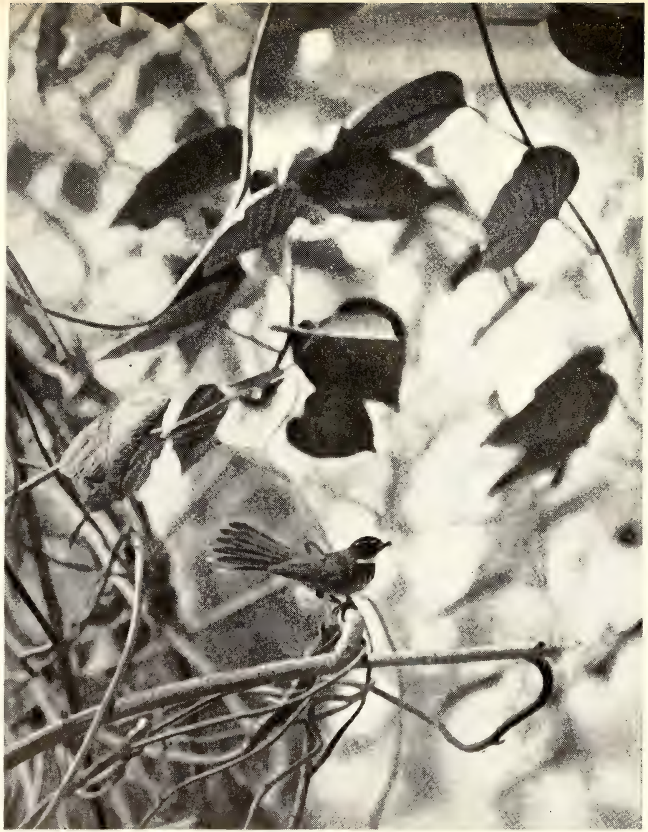
The Bay-backed Shrike : *Lanius vittatus* Valenciennes.

Field identification : Size about that of a Bulbul. 'Common in cultivation ; a small bird with a longish tail, broad grey and white head with heavy black marking, maroon back and black and white tail, the markings sharply defined and conspicuous ; perches in exposed situations.' (*Whistler*).

Specimens : *St. X. College* : 113 Jūhū 10-10-33 ; 153 Jūhū 27-10-33 (H.A.).

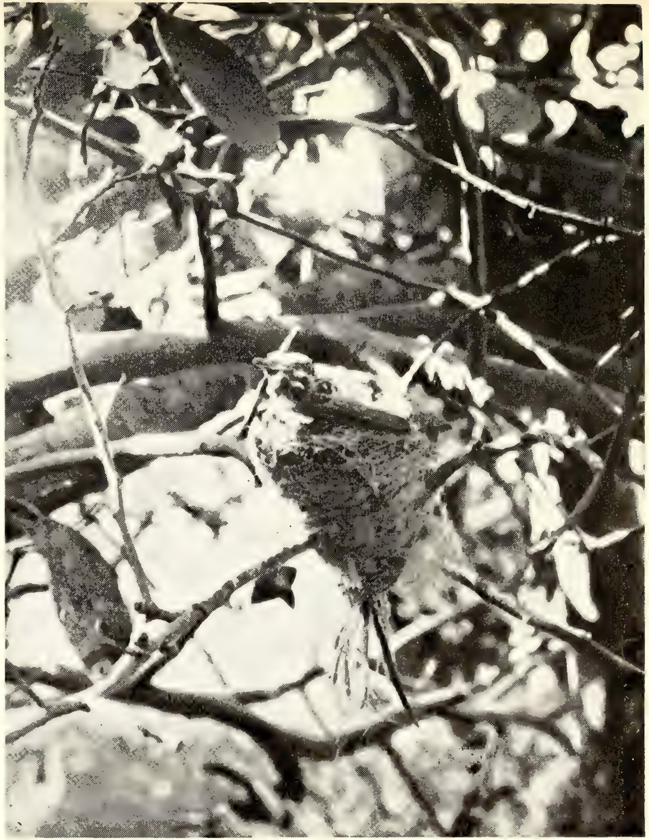
Though common in the Deccan the Bay-backed Shrike only straggles into the Konkan from October to March. We have only observed it amongst the Babool trees on the islands in the mud-flats and in the open fallow country at Kihim.

Breeding : It is known to breed at Khandala (*N. & E.*, i, 314).



Photos

The White-spotted Fantail Flycatcher
(*Leucocirca pectoralis*).



Sálim Ali

Nest of White-spotted Fantail Flycatcher
with chicks about 10 days old.

The Rufous-backed Shrike : *Lanius schach erythronotus* Vigors.

Local name : *Potia.*

Field identification : Larger than the Bulbul with a longer graduated tail. Head grey with thick black stripe through the eye. General colour grey with pale rufous-washed underparts, rufous rump and dark wings and tail. Singly, in open country.

Specimen : *B.N.H.S.* : Several from Pāli Hill, Santa Cruz, Andhēri, Kurla, etc. *St. X. College* 95 Borivli 28-9-33 (H.A.).

This bird arrives in considerable numbers regularly during the first week of September (one record 13 August, Kihim !) and stays till April (latest date 19th). When well 'in' this shrike is a prominent feature on the suburban countryside. It is particularly fond of country where scrub jungle, date palms and paddy cultivation abound. The neighbourhood of the Pawāi Lake, where a large portion of Bombay's toddy supply comes from, is specially favoured. It takes up its position on a date leaf or some other exposed situation and utters harsh 'screams' as if in distress, somewhat after the style of the Myna's alarm calls. At times it also produces a rambling song not unlike a Dhyal's, but the notes are on the whole harsher, the volume less, and it is altogether more prolonged. It is a clever and convincing mimic and imitates the calls of a large number of species to perfection. While with us these Shrikes are mostly seen as solitary birds each appearing to establish its own feeding territory or sphere of influence. From its coign of vantage it pounces upon any grasshopper, lizard and the like that happens to show itself on the ground. We have seen one catch an earthworm and impale it on a karonda thorn.

Breeding : Br. Navarro took c/2 at Khandala in April (of this race or *caniceps?*).

The Pale Brown Shrike : *Lanius isabellinus* Hempr. & Ehrenb.

Specimens : *B.N.H.S.* : ♀ 14-12-99 Esplanade, Bombay (J. M. Mason) ; *St. X. College* 225 ♂ 13-2-35 Andhēri (H.A.).

The occurrence of this bird in our area is exceptional. It was shot in *Euphorbia* and Babool scrub bordering the mud-flats at Andhēri. Only one previous record exists from the famine year of 1899 when a large number of unusual species were driven south by the drought.

The Common Wood-Shrike : *Tephrodornis pondicerianus pondicerianus* (Gmelin).

Field identification : Size of a Bulbul. 'A grey bird with a pale eye-brow and a dark band through the eye, and white outer feathers in the tail' (*Whistler*). In trees in lightly wooded country.

Specimens : *B.N.H.S.* : From Vihar Lake, Trombay Hills, Pāli Hill, Andhēri, Kandivli etc., *St. X. College* 217 Vihār 29-12-24 (H.A.).

Noted : Pāli Hill, Santa Cruz, Kandivli, Trombay Hill, Kihim.

Resident. It affects lightly wooded country specially teak and other deciduous forest, and parties of 4 or 5 birds often follow one another from tree to tree. The birds creep about the branches like Ioras and snap up insects like flycatchers. They occasionally venture into gardens in the suburbs. They have several pleasant whistling notes 'wheet-wheet' followed by a quick interrogative 'whi-whi-whi-whi'?

Breeding : H.A. took a nest with 3 fresh eggs on 21 April. The nest was a small cup of fibres plastered over with cobwebs placed in a horizontal fork of a *Bombax* branch near the tip. The nest matches its surroundings beautifully and would be difficult to locate but for the movements of the owners. Br. Navarro took a c/3 at Khandala in May.

The Orange Minivet : *Pericrocotus flammeus* (Forster).

Field identification : A brightly coloured bird like the next, but slightly larger.

Specimen : *St. X. College* 215 Hills north of Borivli 30-12-34 (H.A.).

The specimen is the only record we have from Salsette. Another was seen at Tungar near Bassein on 2-4-34, and it appears to be commoner in the hills northward on the mainland.

Breeding : On 7-6-37 Br. Navarro took c/2 at Khandala. On 27-6-37 a female was observed collecting lichens off a tall tree in forest about 20 miles north of Bhiwandi along the Wada road.

The Little Minivet : *Pericrocotus peregrinus peregrinus* Linn.

Field identification : Slightly smaller and slenderer than a Sparrow, with a longish tail. Male with blackish-grey head and breast, grey back, orange crimson underparts and the same colour in wings and at base of tail above. In the female the red portions of the male are yellowish and she is duller coloured on the whole. Flocks flitting about in trees in gardens and light forest.

Specimens : *B.N.H.S.* : From Bombay City, Andhēri, Trombay, Malad etc. *St. X. College* 27 ♂, 28 ♀ 6-8-33 Marōl (H.A.).

Noted : Andhēri, Malād, Pāli Hill, Chembūr, Bombay, Kihim.

Resident and fairly common throughout our area. Parties of from 4 to 8 birds may be seen following one another from tree-top to tree-top, keeping up a low musical cheep. In the cold weather flocks composed entirely of males may be seen. It is partial to mango orchards and well-wooded gardens. Parties may usually be seen on the Silk cotton tree in flower in company with birds of many species.

Breeding : The pair shot on 6 August were evidently nesting. The testes of the male measured 6×4 mm. and the oviduct of the female was greatly distended indicating that she had laid. On 4-6-34 a female was observed feeding a full-fledged young out of nest.

The Black-headed Cuckoo-Shrike : *Lalage sykesi* Strickland.

Field identification : Size Bulbul. Male ashy-grey with blackish wings and tail and black head. Female has the head grey and the underparts barred black and white. Singly or pairs in mango orchards and wooded country.

Specimens : *B.N.H.S.* : From Chembūr, Andhēri, Tūlsi Lake. *St. X. College* 218 24-1-35.

Noted : Andhēri, Tūlsi Lake, Kihim, Chembūr, Gōrēgāon (in mangroves) Borivli, Khandala, Panchgani.

Resident, and not uncommon. Though never seen within city limits this Cuckoo-Shrike may be met with in the suburbs almost everywhere. It frequents deciduous forest and mango orchards. The 'Lake District' is specially favoured and here it is partial to young date scrub. It goes about singly or in pairs. The male has a pretty, clear whistle consisting of several notes and ending in a quick-repeated 'pit-pit-pit' which we have only heard in the hot weather and the rains.

The stomach of a specimen contained remains of insects and their eggs and a large green caterpillar.

Breeding : EHA took a nest with 3 eggs 'not far from Bombay' in June. Barnes (*J.B.N.H.S.*, iv, 90) found it breeding at Vāsind on the mainland in July.

The Large Cuckoo Shrike : *Graucalus javensis macei* (Lesson).

Field identification : Size somewhat smaller and slenderer than a Pigeon. A grey bird with a broad dark eyestreak. Whitish underneath. Quills and tail black. Eyestreak in female less conspicuous and lower plumage barred grey and white. Singly or pairs in trees in wooded country.

Specimen : *B.N.H.S.* 14-3-26 Gōdhbunder (S.A.).

Noted : Chembūr, Marōl, Jūhū, Borivli, Panvel, Kihim, Karnala, Tungar.

EHA states in his *Common Birds of Bombay* that it is common, but we have found it decidedly uncommon and nowhere plentiful except at Tungar near Bassein. It frequents well-wooded country such as that about Gōdhbunder and the lakes, usually moving about in pairs which continually call to each other in a peculiar musical scream.

Breeding : No records from our neighbourhood are available and we are not certain about the status of this bird in Salsette though apparently it is a resident.

The Ashy Swallow-Shrike : *Artamus fuscus* Vieillot.

Field identification : Size about Bulbul. Squatter and with shorter tail. Very swallow-like on the wing, but heavier. General colour dull-grey with a pale patch on rump. Bill heavy and somewhat sparrow-like. In open country with palmyra palms.

Specimens : *B.N.H.S.* : ♂ ♀ 17-11-27 Chembūr (S.A.); *St. X. College* : 71 Gōrēgāon 8-9-33 (H.A).

The Ashy Swallow-Shrike is common in the palmyra country in Salsette.

Photos *Sálim Ali*

The Ashy Wren-Warbler (*Prinia socialis*)
on Coral Flowers.

The Black Drongo (*Dicrurus macrocercus*)
attending on grazing cattle.

As many as 30 birds may be seen huddled together on a single palm leaf or on a telegraph wire. They roost at night in the same manner on palmyra palms. They may often be seen hawking together in loosely scattered parties with their heads to the wind like many birds that find their food in the same way, e.g. terns, swallows and swifts. They also make sallies from a perch to which they return after circling round like bee-eaters. Another method is to swoop down like a Kestrel on some insect on the ground and bear it away in their bill.

The food consists of insects. Butterflies are largely taken. One bird had swallowed a large Pentatomid bug.

Breeding: The nesting of this species seems inseparable from the palmyra palm (*Borassus*). The season is from the middle of March to June. The nest is a rough platform of palmyra fibres placed at the base of the leaf. The usual clutch appears to be of 3 eggs. Like King-crows they are pugnacious when nesting and will attack birds much larger than themselves.

Barnes found them breeding in palmyra palms on Elephanta Island in May. Swallow-shrikes seem to undertake sudden migrations of a few miles, disappearing from favourite localities and reappearing after some time.

The King-Crow or Black Drongo: *Dicrurus macrocercus peninsularis* Ticehurst.

Local name: *Ghosia.*

Field identification: Size about Bulbul. Glossy jet black with long forked tail. Familiar species present everywhere by cultivation and grazing cattle.

Specimens: *St. X. College*: 33 Marōl 6-8-33; 104 Andhēri 4-10-33; Andhēri 6-12-34; 213 Vehār 29-11-34 (H.A.).

Noted: Bandra, Māhim, Chembūr, etc. etc.

This is one of the commonest birds of the low country, and in fact is met with wherever the trees are not too close together to hinder its style of attack. Telegraph wires along a railway are favourite resorts, and if a census of birds were taken from a railway carriage the king-crow would easily top the list.

King-Crows have no connection with crows, except that they are their inveterate enemies during the breeding season. The crow has only to approach the neighbourhood of a drongo's nest to be mobbed. He is set upon and buffeted by the owners, whose superior agility enables them to dig beakfuls of feathers out of the intruder's back. This is we believe the only bird that scores over the crow in open warfare. And the crow knows it and holds the drongo in respect.

Drongos ride on the backs of cattle and buffaloes as they graze, and pick off the insects disturbed by the animals' feet. The cattle egrets stalk alongside to the same purpose. Fires, again, drive out insects from their hiding places, and you have but to fire a patch of grass or scrub to bring the drongos of the neighbourhood scurrying to it.

At Karnala an individual was seen busily hawking the large rock-bee (*Apis dorsata*) which were present in large numbers.

Drongos carry their food as well as their nesting material in their beaks, but a luckless grass-hopper that escaped from the bill was seen to be promptly re-captured in the claws.

Breeding: The duets which are a sure indication of the approach of the breeding season, begin in February, and the courtship is a prolonged affair. We have not seen eggs laid before May and June. The nest is usually placed at some distance from the ground, 15 to 30 feet as a rule. The tree chosen is often thorny like *Erythrina, Bombax* or *Bridelia retusa*. Mango and Neem trees are also patronised. The nest, a loose cup of fibres and fine twigs, is half-slung, half-wedged into a horizontal fork, often near the extreme tip of a branch.

The eggs, often visible through the flimsy bottom, are usually three in number, though we have seen nests with 4 and 2 eggs. The same site or tree is used in successive years.

The birds are bold and aggressive in defence of their nest, and make determined onslaughts on would-be egg-collectors. Large birds and mammals in the vicinity are constantly chivvied. The alarm note is long-drawn 'phiu-phiu'.

The Indian Grey Drongo: *Dicrurus longicaudatus* (Jerdon).

Field identification: Size and appearance as above, but slimmer and with the underparts duller and distinctive. Keeps to wooded country and hills in Salsette and not seen near open cultivation.

Specimens: *B.N.H.S.* 4-12-34 Marōl (C. McC.) and others. *St. Xavier's College*: 200, 209 Bassein, December '34; 212 Vehār 29-11-34 (H.A.).

We had not suspected the occurrence of this bird in our area until one was accidentally obtained in mistake for the black drongo. Since then, however, we have seen numerous examples and the records go to show that it must be a fairly regular winter visitor to Salsette, especially in December and January. The earliest record is a specimen in the Society's collection obtained by E. Henricks at Bandra on 22-10-28.

The habits are similar to those of the previous species except that it does not appear to venture out usually into open country and cultivation and is more confined to the well-wooded portions of the island.

The White-bellied Drongo: *Dicrurus caerulescens* (Linn.).

Field identification: Size and appearance as of the black Drongo, but glossy indigo in colour instead of black, with the belly and under tail white.

Specimens: *B.N.H.S.* ♂ 11-12-99 Kalyan (J. Brand); 171-27 Bhāndūp (McCann).

Noted: Tūlsi Lake Environs, Kihim and Parōl Pāra (Alibāg Talūka).

Resident, but rare, in the hills of North Salsette. It is confined to well-wooded country. It is a noisy bird and our impression is that its notes are more musical than those of the Black Drongo. It is an accomplished mimic besides. We have, among other species, heard it imitate the Iora and the Tailor Bird to perfection. In the case of the former, not only were the whistles reproduced, but also the occasional 'chr-r-r' with which these are punctuated.

We have not found it breeding within our area or its immediate neighbourhood, though it doubtless does so.

The Bronzed Drongo: *Chaptia aenea malayensis* Blyth.

The *Fauna* gives the distribution of this Drongo as 'The whole of Western India, from South Travancore to Bombay'. Butler records it as far north as Khandala. One of us (H.A.) has observed it at Tungar near Bassein (on the mainland); on 16-2-36 a specimen was shot under Funnel Hill, Panvel (Kolāba District) in heavy forest where it appeared to be fairly common.

The Racket-tailed Drongo: *Dissemurus paradiseus malabaricus* (Latham).

Field identification: Size about that of a Myna, glossy black with a long tail. The bare shafts of the two outermost tail feathers are prolonged for about 12 inches beyond the tail proper and end in 'rackets'. A well-developed crest from forehead lying backwards over the crown. Sexes alike. Singly or scattered pairs and parties in forest.

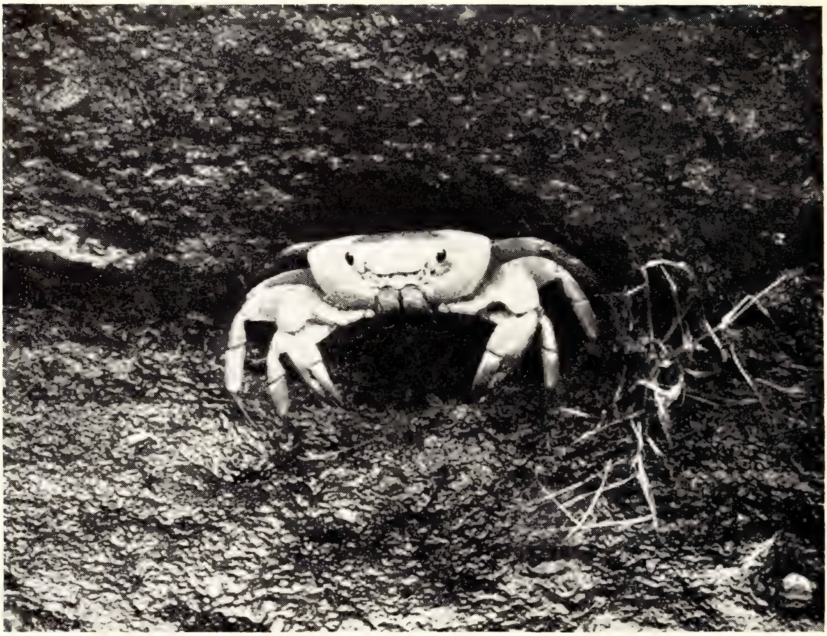
Specimens: *B.N.H.S.*: ♂ 22-1-24 Andhēri (S. H. Prater); ♂ 20-10-28 Thāna Hills (McCann). *St. Xavier's College*: 40 23-7-33 Kaneri; 60 3-9-33 Jogēshwari (H.A.).

Noted: Powāi, Vehār, Tūlsi, Gōdhbunder, Borivli Hills; several places in the Kolāba District.

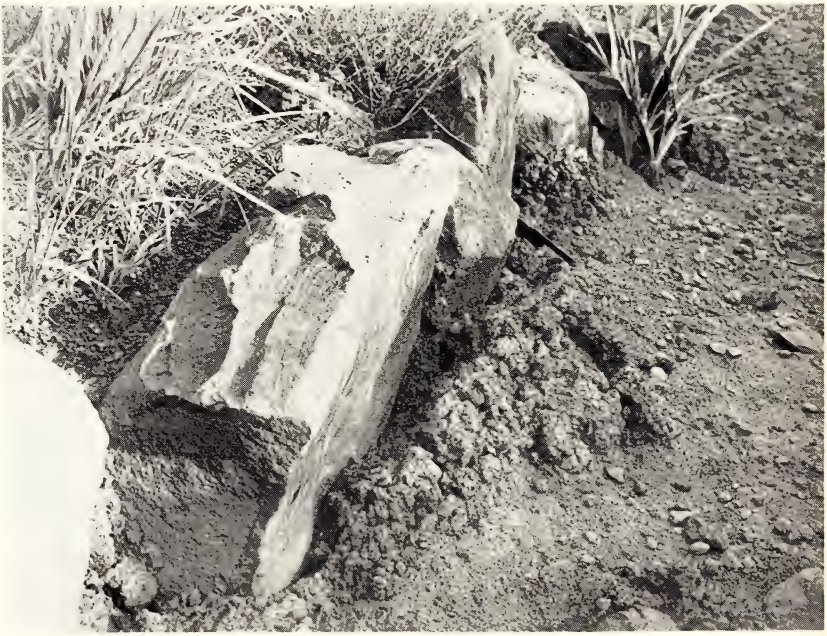
Resident and common in the better wooded portions of Salsette. It has a large repertoire of loud metallic notes and it is an excellent mimic besides. We have heard it reproduce to perfection the calls of the Shikra and of *Spilornis cheela*.

Breeding: We have observed a bird building in Salsette on 3 May and have records of nests and eggs on 17 and 30 June, 2 July and 18 August. On the last date full-fledged young were noted being fed out of nest. The best time for eggs seems to be June and July. The nest is a fairly deep cup of rootlets and palm fibres with little cobwebbing on the outside and without extra lining, placed in the fork of a branch or at the base of the leaf stalks of a palmyra palm, between 30 and 50 feet up. Two or three is the number of eggs we have usually found.

(*To be continued*).



A female of the common Land Crab. [*Paratelphusa* (*B.*) *guerini* (M.—Eds.)]



Castles of the common Land Crab. [*P.* (*B.*) *guerini* (M.—Eds.)] alongside rocks.

Photos by Author.

NOTES ON THE COMMON LAND CRAB *PARATELPHUSA* (*BARYTELPHUSA*) *GUERINI* (M.-EDS.) OF SALSETTE ISLAND.

BY

CHARLES McCANN, F.L.S.

(*With two plates*).

At the Second Entomological Meeting held at Pusa in 1917 Mr. Bainbrigge Fletcher, Director of the Entomological Research Institute, Pusa, referring to the destruction of paddy crops by land crabs, remarked: 'Crabs have come into notoriety lately, especially in Madras, as paddy pests. In Bihar we have only had one report of crabs attacking paddy, but about five or six years ago we had a report from Karachi of damage by crabs in fields of young paddy. Recently they have come into prominence in Madras and Burma and there seems to be no doubt that crabs do some damage to rice plants.'

The Island of Salsette is infested with land crabs; but no utilitarian motive prompted me to investigate their habits. What really roused my curiosity was the appalling number of dead crabs lying about the fields and byways, in season and out of season. I wished to determine the probable cause of their death. But, as is usually the case in such enquiries, one point led to another and the net result was a collection of interesting notes which had little to do with the death-causing factor among crabs.

In this paper I deal with one single species, *Paratelphusa guerini,* and unless otherwise mentioned all my remarks are confined to it.

COLOUR.

Adult: At the time of their appearance, at the onset of the rains, these crabs display a wide range of colour. Some are a dirty white, others are purplish brown, and many are mottled with a mixture of both tints. Why this difference of colour? At first, I was under the impression it might be a sexual character, but an examination of several dozen soon dispelled this idea. The colour variation was common to both sexes. A second explanation suggested itself; that this colouring might possibly afford some particular advantage to the species, but a solution to this problem would have to be sought in its mode of life or its environment. The variation may or may not have some adaptive significance. Only observations in the field would suggest a solution to this interesting problem.

The crabs appear with the rains. Before the burst of the monsoon the ground is littered with dead leaves of almost every hue. Upon this variegated surface the crabs live. When disturbed they either run a short distance and stop, or remain perfectly still, alert and on the defensive, with the pincers outspread ready to nip. When on the move, the crabs where possible avoid open ground and scurry under the leaves. Anyone who has seen them in such environment cannot but conclude that the colouring, varied though it be, is protective. It is in perfect harmony with the variegated environment. The hues of the crabs blend remarkably with the colours of the fallen leaves among which they live and take shelter. This, I suggest, may be the explanation of the variation. [However, in open fields (agricultural land) the yellowish white 'type' appears to be predominant and at a distance may resemble a piece of quartz.) But with the weeks of rain the carpet of leaves loses its variegated colours; the leaves decompose and become black, and with the change of scene the purplish brown and mottled crabs 'disappear', leaving only the yellowish white ones. What became of the darker coloured crabs which were so common at the onset of the rains? Do they lose their richer tones and become yellowish? Are the darker ranges of colour but a temporary phase? This, I believe, is what happens. Purplish brown crabs which I kept in captivity lost their richer hues after a while and became pale yellow. There is presumably a definite bleaching process at work and this seems to me to be the only plausible explanation of the 'disappearance' of the crabs exhibiting the deeper ranges of colour. The yellow crabs are now fairly conspicuous objects against the dark humus of the ground or rocks. The protective colouring has been discarded. A factor which was till then apparently significant to the species in the struggle for existence is now no longer of importance. For, by the time the crabs have assumed this phase of colouring their existence is no longer essential to the continuance of the species. On emergence, the females, laden with young, are in need of protection but by the time their colouration has faded and all the crabs are uniformly yellow the young have been shed—they have accomplished their chief duty in life.

There is perhaps one serious objection to the theory of protective adaptation, namely, the colouration of the males, which as we shall observe later, have no need for such protection. However, the colouring may be due to some deep-seated physiological character which is common to both sexes and is beyond the scope of this paper. Nevertheless the colour protective adaptation is again supported by the colouring of the young.

Young: Young crabs, while still in the care of the mother are earthy brown in general tone with a slight tinge of flesh pink on the pincers. The carapace is really translucent and the brown colour is mainly due to the colouration of the internal organs showing through. As the young crabs are generally deposited in or find their way to flowing water, where they live and develop, the brown colouring makes it almost impossible to see them against earth. As growth proceeds, and this is fairly rapid, the crablings become lighter and lighter in colour eventually becoming yellowish white (some are pale reddish brown). This change from brown to yellow appears to be mainly due to the deposition of calcareous matter within the shell (exoskeleton). Accordingly the shell becomes more opaque and in old crabs is heavily calcified throughout—a sure sign of old age! The carapace of crabs of the season are usually semi-translucent and the contents of the crab frequently show through making that region darker than its surroundings. By the end of the rains, after several months, the adult stage is reached.

Breeding.

There appears to be little definite knowledge regarding the breeding habits of these crabs. In volume iv, p. 190 of the *Cambridge Natural History Series* dealing with the Crustacea and Arachnids, the author writes:—'The fresh-water crab *Thelphusa fluviatilis,* common in the South of Europe and on the North coast of Africa, belongs to the Cyclometopa, and is interesting from its direct mode of development without metamorphosis.' There is no doubt that we have the same direct development in *guerini* which belongs to a closely allied genus. The actual period at which mating takes place is still unknown.

On emergence the primary concern of the crab is the continuance of the species. However, as the females are laden with fully developed young, breeding evidently took place much earlier. When the crabs appear after the break of the rains, the females appear to be predominant in certain localities while in others there seem to be mostly males. The majority, if not all, the females are laden with young scarcely half a centimeter across the carapace. The number of young carried by each female seems to depend largely on her size. The young are held in a compact mass by the abdominal segments and the *pleopods*—metamorphosed swimmerets.

Disturb one of these females; she will either scuttle away to safety, dropping several of her young as she goes, or she will stand on the defensive. This 'premature' shedding of her young probably results from excitement on the part of the parent as she tightens her hold on the mass of young, thereby pressing some out. Generally the young remain with the mother for several days before she 'sheds' them or they leave on their own accord, when ready to fend for themselves. Nevertheless, crablings are quite capable of supporting themselves at a very early age.

As we have already observed, the adult females emerge from their burrows with their young fully developed. In all my wanderings I have never observed crabs in copula. The questions naturally arise, When do they copulate? and, When are the eggs deposited and hatched? The answers to these qustions are yet awaited. One thing is certain, and that is, that the eggs are laid and hatched when the crabs are underground.

According to Mr. Wagle (Dept. Agric. Bom., Bull. No. 118 of 1924, *Land Crabs as Agricultural Pests in Western India*, p. 20), the burrows are interconnected, 'If the openings of a burrow are further traced it is seen that most of them are connected superficially within a foot or two of the soil surface, though ramifications at a depth of four or five feet are not uncommon. A few only go deep down and each one of these burrows harbours a crab, probably the off-spring of the same mother liberated in the same burrow in connection with the mother burrow.' However, in none of his diagrams does Mr. Wagle indicate that there are any such interconnecting passages. If the burrows are thus interconnected, the crabs are able to visit each other during the period of æstivation, so that it is really immaterial whether several crabs æstivate together in one chamber or alone in separate chambers—the sexes would have access to one another.

Considering the data we have before us, it is possible and even probable that copulation generally takes place within the burrows. Whether crabs are active within their burrows throughout the dry weather is yet another point which needs investigation.

GROWTH.

Crablings : As already indicated, the females emerge laden with young. The young are but miniatures of the adults. After a brief period of maternal care the young are 'shed' and have to fend for themselves. The country is teaming with them. The number of young produced by a single female appears to be dependent on her size, small females having fewer young than larger ones. The greatest number I have recorded from a single individual was 252—what a family ! Each youngster at this stage measures a little over 5 mm. across the carapace. Should the young at this age fall away from the parent they frequently climb back into the mass and remain with her, if unable to do so, they are quite able to fend for themselves.

During the early period of their lives crablings spend far more time in water than do the adults, feeding on the bottom of small streams.

Moult: At the time of moult crabs usually secrete themselves under stones, in holes or remain submerged in water. I have repeatedly found crabs soon after they had moulted and once had the pleasure of seeing one 'walk out of its old self'. The carapace splits horizontally across the 'face' of the crab and opens like the lid of a box. The creature then gradually and laboriously draws itself out of its 'old skin' and then sinks down to rest till its coat of mail hardens once more. On emergence from the old shell the animal is generally perfectly white (sometimes tinged with pink), soft and defenceless. It is limp and unable to walk; it lies almost motionless till it has hardened again. If the crab be bruised at this period a milky exudation takes place. The hardening process is slow.

SENSES.

Sight : Sight is well developed.

Smell: The sense of smell is apparently very keen. Experiments by way of drawing a piece of meat tied to a string through water which was then removed, clearly indicated that the crabs were able subsequently to follow the trail quite easily. Again meat juice dropped in the water immediately attracted the crabs. They would grope about with their pincers in the line taken by the flow of the juice.

Sounds: At first it might appear strange that a crab is able to produce any kind of sound at all. Nevertheless, it is capable of making quite an audible hissing noise on occasions. This is effected by rapidly 'blinking' the eyes in and out of their sockets. At first, when I heard this sound, I thought that my ears deceived me, but when I listened more closely and watched the animal I soon discovered how it was made. The lower margins of the eye sockets are provided with a fringe of stiff hairs. This undoubtedly forms a natural brush for cleaning the eye itself—an automatic cleaning apparatus! When this fringe is dry and the eye is rapidly moved across it, it produces a soft hissing sound. The sound I have noticed only when 'dry' crabs are freshly caught. Having once discovered this I paid a little more attention to it. It seems to be a habit of the crab to produce this sound when closely approached and when caught. This noise is apart from the usual bubbling noise made in the process of respiration.

HABITS.

Burrows: The burrows are at first made large enough to admit the crab sideways and to allow of the free play of the pincers. As the crab grows it enlarges the burrow accordingly. The burrows are made either in the fields themselves or more often in the bunds, but the site of the burrow is dependent on the amount of water present. When the fields are flooded the crabs seek higher ground, such as the bunds, for if the burrows were continually under water the animals would be drowned. Towards the end of the rains, when the water level in the soil falls, the crabs return to the fields to make their holes and build their final castles. Away from paddy fields, they burrow into the banks of streams just above the usual water level. Final burrows are generally excavated in the bed of the streams. Unfortunately, lack of time and opportunity have prevented me from making a systematic study of the course of the burrows. According to Mr. Wagle (l.c.) the crabs dig down deeper and deeper as the level of the water falls. The course is irregular and the burrows are interconnected by side tunnels.

Life under ground: Towards the close of the rains the crabs are to be seen actively excavating burrows, collecting leaves, grasses and other food which is conveyed into the burrow. This they continue till the land surface is almost quite dry. When sufficient storage has been accomplished they retire till the break of the next monsoon. Once the dry period has set in all crabs retire irrespectively whether they are near perennial water or not, though crabs so favourably situated do go down a little later. Within the burrow now lies the secret of the crab's early life-history which still awaits solution.

'Castles': Crabs build small or large castles throughout the rains but the final castles, which are generally larger, are built when they are about to go below the surface. The time when building commences would vary with weather conditions and locality. The building of the castle is an effort to get rid of some

of the earth within the burrow which is piled up at the entrance, but this is perhaps not the only reason. It possibly affords a certain amount of protection to the burrow by keeping off would-be intruders. Fallow fields and low lying land are favourite sites for the final burrow.

The walls of the castles are composed of pellets of mud brought up when still wet. The pellets are heaped up on each other and eventually form a compact mass. These pellets appear like excreted earth or a fine mixture of mud with some secretion. The castles are frequently conical in shape and may occasionally rise a foot or more above the surrounding ground, but they usually vary between 2 and 8 inches in height. When the castle is complete, the entrance of the burrow is plugged up from within and the crab enters on its long period of life under ground.

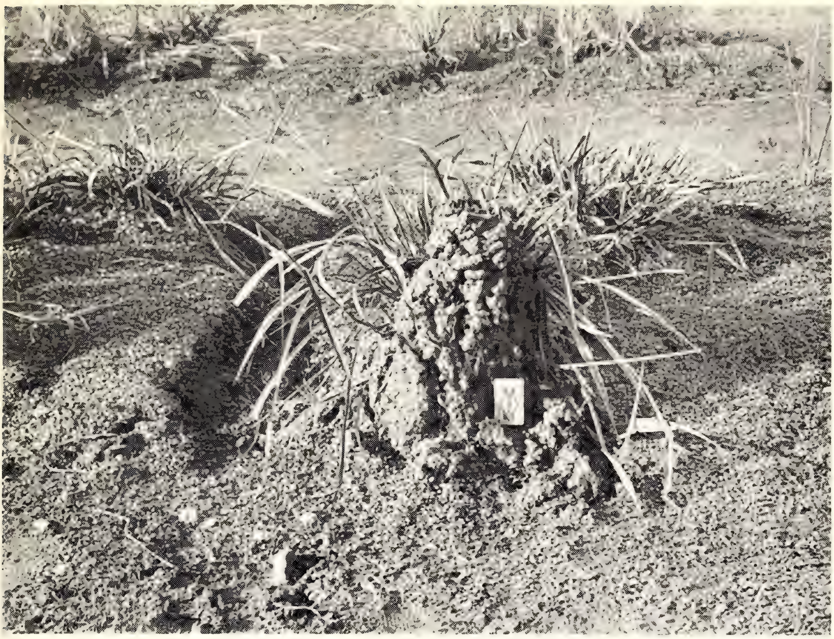
Why these castles are constructed is problematic. As already suggested it may be to keep off intruders. At the time when the crab is about to æstivate there are numerous other animals which are also looking for a suitable retreat. Some are unable to excavate their own burrow; others prefer to find a convenient ready made burrow rather than dig one, and find a crab hole convenient. If the entrance of the crab's burrow were flush with the ground the entrance with its fresh plug of mud would be easily accessible. But as the entrance is raised and the walls of the castle solid they act as a bluff which is mistaken for a clod of earth!

When the crabs first appear the females are a lot more cautious than the males and are less frequently seen in the open. When sufficient rain has fallen to make puddles and cause the streams to flow, the females laden with young congregate on the banks and in the water. During this period the females spend much time submerged on account of their young and it is also at this period that the young leave the parent. In such localities there is always a sufficiency of hiding. On the slightest alarm they hurry away.

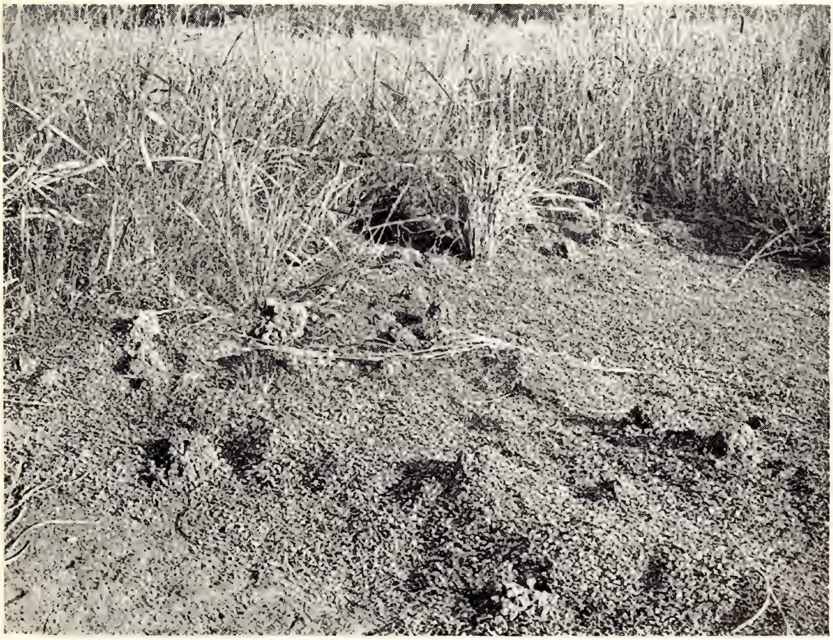
During showers and under the cover of darkness the adults wander about much, but when the sky is cloudy or sunny they make for the water.

As the monsoon advances the adult crabs tend to decrease in numbers very rapidly and considerably. The younger generation now take their place. Where do the old crabs go or what happens to them? Do they die out or retire into their burrows once more? These are questions that started me off on these investigations. Some may volunteer the opinion that the crabs disappear in the vegetation. This I am not prepared to accept as young crabs are all about. That they do not retire to their burrow is certain for they would be drowned, as they are not able to stand submergence indefinitely. From personal experience, I am of the opinion that these crabs live but one year and that they die in the open during the monsoon or soon after.

When within the burrows, the chelae are generally carried adpressed to the body, but in case of attack the chela nearest to the intruder is placed at the entrance ready for action. Once a crab seizes an intruder it will not let go easily. This frequently



A castle of the common Land Crab. [*Paratelphusa* (*B.*) *guerini* (M.—Eds.)] in an unused field at the end of the rains. (*Match box for comparative size*).



Several castles of the common Land Crab. [*P.* (*B.*) *guerini* (M.—Eds.)] in a field at the close of the monsoon.

Photos by Author

leads to the loss of the chela or the capture of the crab. This habit is common to most crabs and is frequently made use as a ruse to capture them. People who catch crabs by this method tie a piece of meat to the end of a stick. The stick is thrust down the burrow. The crab in time seizes the bait and is gradually drawn out of its hole. The hole is then blocked with the free hand or foot and the crab is caught. Nevertheless this habit of the crab though it may frequently lead to its death at the hands of men is also a means of securing much of its animal food.

Whether these crabs are nocturnal or diurnal or both, is a difficult matter to decide. This would depend much on weather conditions. The crabs are about both day and night during the short period of their activity on the surface. When the weather is cloudy and rain is continuous they may be seen about at any time of the day or night. However, I am inclined to believe that they are more nocturnal as they appear to be much more numerous and active under the cover of darkness. At night they wander farther from their burrows. Apart from the fact that the crabs do not like direct sunlight which desiccates their gills, they probably find a certain amount of protection from their enemies at night.

Another point that needs consideration is that their period of activity is during the monsoon when the sky is overcast with dense clouds, so it is not surprising to find them about during the day. When the sun appears between showers and it gets really hot, the crabs retire to a goodly extent, if not into their burrows, into water or shade.

Though these crabs cannot remain submerged for many hours at a stretch, they are as well at home in water as on land; but they are not able to swim. They merely crawl along the bottom. During the monsoon, when the air is damp, they are able to remain on land for weeks without showing any ill effects. This indicates that they are well adapted to terrestrial life.

When the crab respires on land bubbles appear continuously at the mouth, but when in shallowy water, the mouth parts are lifted above the surface from time to time and then submerged; at the time a series of bubbles arise from near the base of the last pair of legs. This action is continuous.

These crabs do not appear to be pugnacious. They frequently live together in the same hole (during the rains) and inhabit the same pools feeding within close range of another. However, I have frequently observed a crab resent the entrance of a particular individual into its burrow whereas another went in unmolested. Whether this behaviour indicates a certain social grouping or whether it is just a submission of a weaker to a stronger one is hard to say. Occasionally there are fights but these contests take on more the form of sham-fights—there is much display of arms but actual damage is seldom done, as one of the combatants usually runs away. Young crabs, as is a common rule in Nature, have a certain amount of respect and fear for their elders. Whether these crabs are really cannibalistic, in so much as they kill and eat one another, is difficult to say; but, it is certain that they frequently eat their dead, picking the soft parts out of the shells. On the whole they appear quite peaceable among themselves. This is borne out by the fact that several may be kept in the same container, if not too crowded, without difficulty.

Generally the sexes may be distinguished by the fact that the males usually carry larger chelae of which one, either right or left, (though generally the left) is larger than the other. Another point which is worthy of note is that on dissection I found that the fat bodies in the females are bright yellowish orange whereas in the males they are dull and not yellow.

Food: Like most crabs, this land crab is omnivorous and it is an excellent scavenger and controller of injurious pests, as we shall notice when we review its menu. Little escapes its attentions. Fresh and decomposing vegetable and animal matter are all included in its diet. Leaves, algae, fruit, insects, amphibia, reptiles dead or alive, are all welcome. Much of the meat is caught at the entrance of the burrows and shelters. Unwary fish are caught as they swim by the submerged crabs. These food observations are not mere generalizations but are based on either experiment or experience in the field.

Once I saw a two-feet-long Checkered Water Snake (*Tropidonotus piscator*) wriggling violently with its head held fast under a stone as though it had been pinned. The behaviour was curious. I pulled at the tail of the snake to find it firmly held. On removal of the stone I discovered that a large crab had the head of the snake in its pincers! Probably the snake went under the stone for shelter or in quest of food, but the crab had forestalled it. When the stone was removed the snake struggled frantically with the crab still holding on. Eventually the crab lost its chela but it still remained affixed to the head of the snake. On another occasion I witnessed a crab dragging a much larger corpse of the same species of snake across an expanse of rock. The back had been partially eaten. I watched the proceedings till the snake disappeared into the crab's burrow. I have frequently witnessed crabs taking things home.

Earth-worms form a good portion of their diet. These they usually catch when abroad at night or when the worms come out during the day. I have frequently seen crabs catch living frogs, lizards, beetles, moths, grasshoppers and other insects. Carcases of any sort when near or in water are frequently covered with crabs.

If one watches a crab feed on wet rocks or at the bottom of a stream, it will be noticed that it is continually ferreting about for some invisible object which is conveyed to the mouth. The pincers are going to and fro from the rock to the mouth and *vice versa*. They appear to be groping for algae. Crabs are seldom guilty of a breach of etiquette—they never overfill the mouth! Particles of food are usually minute. The food is dissected by the pincers into minute bits before it is conveyed to the mouth; but one may occasionally see a crab hold up a large piece at its mouth and get its strong jaws into action.

If a crab had to rely entirely on its pincers for its food, those that have lost them would die of starvation. This thought puzzled me for a time, but a pincerless crab solved the problem for me by a practical demonstration. It lowered its mouth to a piece of meat and worked at it with its jaws. This of course was a rare occasion as crabs are usually very careful of their pincers. While on the subject of missing pincers, it might be mentioned that missing limbs are not replaced.

Enemies : Apart from man, these creatures have a wide circle of natural enemies : mammals, birds, reptiles and amphibians all take a fair toll. In addition to these animals which prey on crabs for food, there are parasites.

Mammals : among the mammals jackals, civets, mungooses and rats exercise a fair check. Otters live largely on crabs. (Though I strongly suspect the presence of otter in Salsette, I have never been able to confirm this. My suspicions are based on droppings.)

Birds : Birds take a heavy toll of young and old crabs. The Malabar Whistling Thrush (*Myophonus horsfieldii*) is perhaps the foremost. This bird catches the crabs, batters them against the rocks till the carapace is broken and feeds on the soft part, but young crabs are often swallowed whole. The White-breasted Kingfisher (*Halcyon smyrnensis*) is another in the vanguard. Crows, herons, egrets, kites and probably a host of other birds also feed on this crab.

Reptiles[1] : Among the reptiles, the Bloodsucker (*Calotes versicolor*) and Skinks (*Mabuia carinata*) are not averse to taking small crabs that they can overpower and conveniently swallow. So far I have no evidence of any snake eating a crab.

Amphibians : In the ranks of the amphibians are found the greatest enemies of the crabs. The bull-frog (*Rana tigrina*) and the common toad (*Bufo melanostictus*) account for a very large number of young of all sizes and the bull-frog will swallow almost full-grown specimens. The skipper (*R. cyanophlictis*) undoubtedly feeds on small crabs, but for this species I have no actual evidence.

The calcareous shells are not digested but are passed in fragments in the excreta.

Parasites : Crabs also suffer from several parasites, both internal and external. In Salsette I have found the leech (*Paraclipus vulnifera* Harding) a serious pest on this crab. It attacks the soft parts at the joints of the limbs and the gills and the lining of the gill chamber. The largest number removed from a single crab was 27, some were attached to the joints but the majority were in the gill chamber. In spite of the accumulation of leeches the crab did not appear to be greatly inconvenienced. Leeches infest the crabs mostly towards the end of the rains. The gill chambers seem to be the breeding ground and when the crab moves about in water the leeches, both young and old, come out of the chambers and wander about the carapace. I am of the opinion that the leeches also use the gill chambers during the dry season as a convenient harbour to tide over this period.

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[1] Since writing the article I caught a young *Varanus bengalensis* and found that its stomach contained almost exclusively young crabs.

This particular species of leech has only once been reported from South India affecting another species of the same genus of crab, *P. hydrodromus*.

Rao Sahib Y. Ramachandra Rao, in 'A note on *Paratelphusa hydrodromus* Herbert, The Fresh-water Crab of South India' (Proc. 5th Ent. Meet., Pusa, 1923, p. 138) writes 'The bronchial chambers of these crabs are found to be infested by a species of leech. Leeches are generally suckers of blood and in this case they are very probably true parasites on the crab, attacking the membrane of the bronchial chamber and the gills and sucking the body juices. Generally three or four may be found in each crab, but in one case fourteen large leeches, besides two or three young ones were noted in a single crab. It is however doubtful if the leech, even if present in large numbers, will form any efficient check on the crab.'

Legend or Observation? In India there is a current belief that the jackal catches crabs by thrusting its tail down the burrow of the crab. The crab seizes the tail and is then pulled out of its hole and devoured. Curiously enough there is a very similar story told by Olaus Maginus, a Scandinavian Bishop, who lived in the sixteenth century, about the fox. This good church dignitary has been responsible for the most fantastic 'unnatural' history stories. He says: 'Sometimes fearing the multitude of wasps, he counterfeits and hides himself, his tail hanging out and when he sees that they are all busy, and entangled in his tail, he comes forth, and rubs them against a stone or tree and kills them and eats them. The same trick, almost, he useth, when he lyes in wait for crabs and small fish, running about the bank, and he lets down his tail into the water, they admire it, and run to it, and are taken in his fur and pulled out.'

Land Crabs and Agriculture: From an agricultural aspect land crabs in general (and the genus *Paratelphusa* in particular) are considered serious pests to paddy crops in certain districts. I have already quoted Mr. Fletcher's remarks in this connection. Mr. Ramakrishna Ayyar referring to the same subject in the Madras Presidency said:

> '. . . It has been observed that damage may be very serious in areas where single seedling transplantation of paddy is done. It appears that the crabs have been attacking paddy for several years but the damage was noticed before the practice of transplantation was to put in bunches of several seedlings.'

It is strange that single transplantation was still continued and the old method not adhered to when damage to single seedlings proved devastating! In Salsette, bunches of seedlings are transplanted, never single seedlings. Careful watching of the paddy fields has shown me conclusively that the damage to paddy crops is negligible in the island. The only period at which I have noticed *P. guerini* nipping leaf blades is before the transplanting of the seedlings. This is generally done by the crabs inhabiting the field of seedlings, but there is no invasion of the field. However the damage is not severe. After transplanting the damage is negligible. A little leaf-collecting is done when the animals are about to retire under ground. At the time when the crabs attack the paddy seedlings they also attack vegetable seedling along with other vegetation. During the rains the crabs move about freely among the fields without doing any 'serious' damage, they are more in quest of animal food.

Mr. Ghosh (Proc. 3rd Ent. Meet., Pusa, 1919, p. 680-87) published a note entitled 'A Note on Crabs as Pests of Rice'. There is an account of the crabs of Bengal which are said to attack paddy. As our species does not occur in Bengal this paper does not concern us directly, but is nevertheless interesting. The arguments brought forward convicting crabs of damage to paddy are not convincing and the damage, taken as a whole, appears negligible. Experiments conducted in metal cylinders likewise do not prove any definite point against the crabs. In fact, referring to the north of the river Gandaki, Barail, Mr. Ghosh (l.c., p. 685) observes:

> 'On the south side there are large rice growing tracts in which no damage by crabs is reported, though crabs are common at a distance of only about two miles from the fields on the opposite side of the river. These fields do not allow water to accumulate in the way the Barail fields do.'

This appears to indicate that the rivers may form a natural barrier to land crabs. Finally Mr. Ghosh observes:

> 'In the writer's experience crabs have not been observed to cause damage on any scale although plants have been observed to be cut and the crop thinned in patches. It could not be made out why plants were cut in this manner. They certainly did not afford food to the crabs. If the crabs had eaten the plants or had been obliged to cut them in order to get their food, it was clear from the enormously large number present in the Barail fields that severe damage would have resulted and probably the rice growing would have been impossible there.'

Further (I.c., p. 687) the same author writes:

> 'In North Bihar crabs cannot be considered a pest of rice in the strict sense of the term.'

Reviewing the literature at my disposal, the only *real damage* crabs are responsible for is: the riddling of the bunds between adjacent fields with their burrows, thereby weakening the bunds, and in time causing them to collapse, letting the water out of the fields. Mr. Shroff (Proc. 2nd Ent. Meet., Pusa, 1917, p. 156) writes, 'These crabs burrow into the *Kazins* (*bunds*) and allow water to percolate through, thus causing paddy fields to dry up in some places.' After much watching, I have arrived at this conclusion also, in Salsette Island. The actual destruction of plants is *very negligible*. If crabs were in the habit of destroying paddy crops, Mr. Ghosh rightly remarks that *paddy growing would be impossible*. This would be the case in Salsette, as the island is infested with crabs.

Preventive measures: The suggestion of preventive measures against crabs seems, therefore, rather premature.

Economics: *Paratelphusa guerini,* as far as I am aware, is of no economic value. In Salsette it is not used as food or for any other purpose by the local people.

Medicinal value: 'According to the Ayurvedic system of treatment, crabs are wholesome diet for patients having pulmonary complaints including consumption.' Ghosh (Proc. 3rd Ent. Meet., Pusa, vol. ii, p. 685).

Advantages of crabs: Land crabs have rightly or wrongly come in for a good deal of abuse; but I am firmly convinced that the abuse is on the whole unjustifiable, particularly in the case of *Paratelphusa guerini*. In accordance with the time honoured saying, 'There is bad in the best of us and good in the worst of us' there is also some good to be found in crabs. Let us now strike a balance sheet.

As already observed, they are excellent scavengers, removing much decomposing material from the surface. Like earth-worms, they are responsible for much turning over and aerating of the soil. Perhaps their most important use is to be found in the value of their exoskeletons. Their shells supply the land with a large amount of calcareous material, very necessary in lands used for the cultivation of paddy. The last but by no means the least point in favour of crabs, is that they catch a lot of insects many of which are injurious to paddy.

Considering these good qualities of the crab and that the case of *serious damage to paddy* has not been conclusively proved against them, are we justified in exterminating them? The balance is in favour of the crab, therefore let us look on them in a more kindly light. Their destruction without actual and sound reasons may result in more serious injury to the paddy crops.

Species of land crabs in Salsette:

(1) [1]*Paratelphusa* (*Barytelphusa*) *guerini* M.-EDS.

This is the commonest crab in the fields and hills of Salsette.

(2) *Paratelphusa* (*Barytelphusa*) *jacquemontii* (Rathbun).

This is the largest of the land crabs in the area. In general colour it is reddish brown or purplish. It generally inhabits the beds of streams, living among the boulders and rocks. It is far more aquatic than *guerini*. It is occasionally found in fields. In habit it appears to be somewhat more nocturnal than *guerini*. This species is much sought after by the local people as an article of diet and is sold in the bazaar.

3. *Paratelphusa* (*Barytelphusa*) *mccanni* Chopra and Das.

Four were discovered among the specimens I sent to the Indian Museum for identification. It is much like *P. guerini*.

4. *Gecarcinucus* (*Gecarcinucus*) *jacquemontii* M.-EDS.

This species is distinguished from *P. guerini* by its more convex shell and closer set, small eyes. The shape of the pincers is also distinctive. It may occasionally be found in fields but is to be considered rare. In several seasons I have only found four or five and these appear to be very local.

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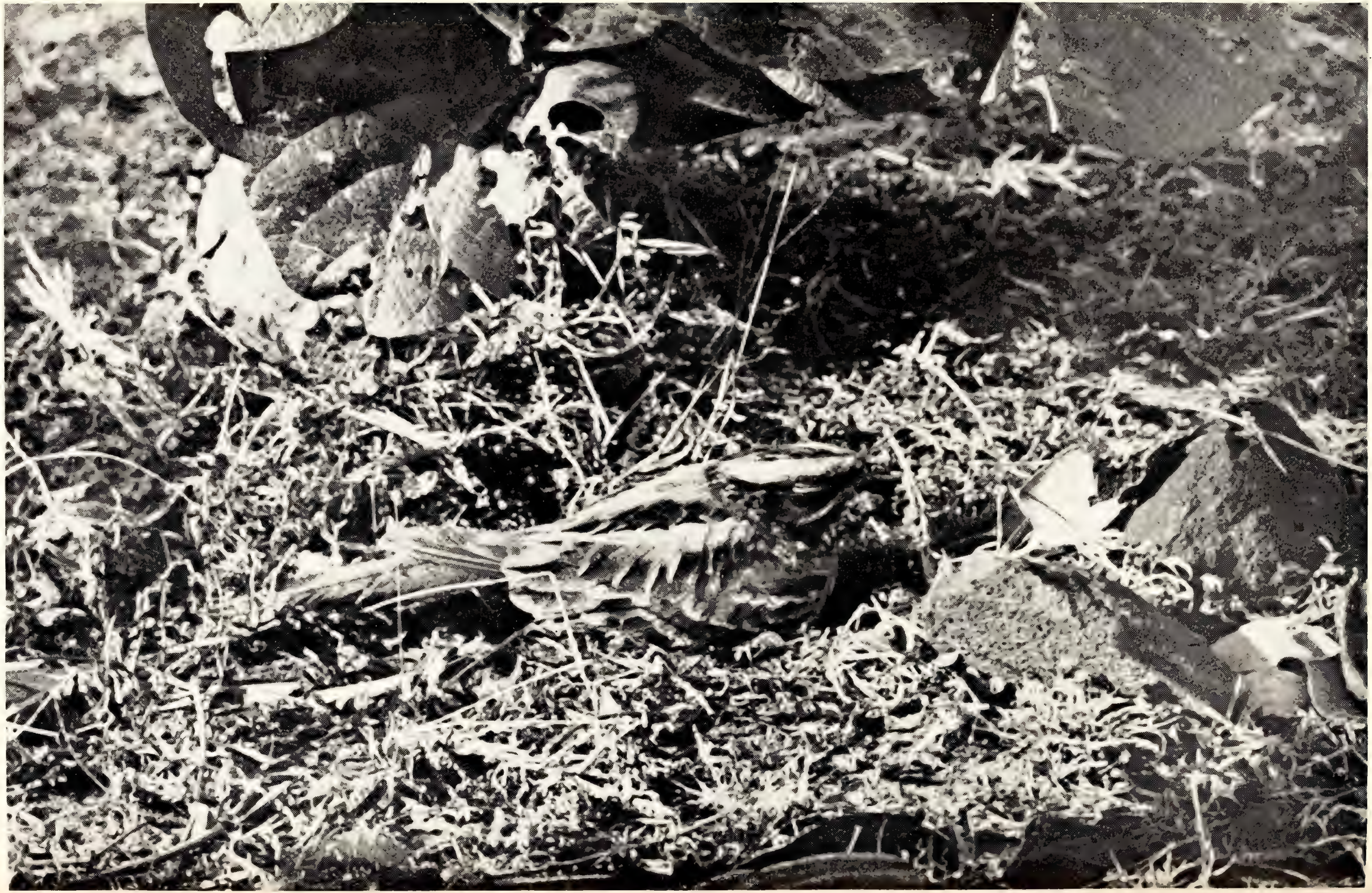
[1] I am much indebted to Dr. B. N. Chopra for kindly going through and identifying the material and also for naming the new species after me.



Common Indian Nightjar (*Caprimulgus macrourus*).

NOTES ON SOME INDIAN BIRDS.

BY

E. H. N. LOWTHER, M.B.O.U., F.Z.S.

II.—NIGHTJARS.

(*With five plates*).

Those who have never seen a Nightjar at rest but only know it as a long-winged bird with an erratic flight shown up sometimes by the headlights of a car have no conception of the sombre beauty of its plumage. Their livery is a symphony of quiet browns and greys, each feather exquisitely pencilled with black, white or buff markings. Nightjars unfortunately only come to life, so to speak, at dusk. This alone makes it sufficiently difficult to study the bird in the field. Accurate observation in India is however, made harder still owing to the occurrence of several species of nightjars, all of them much alike in colouring so that even the expert has difficulty in identifying them correctly. No wonder then that until recently, comparatively little was known of the habits, status or even calls of the genus as a whole. My own knowledge is restricted to four species and my observations practically confined to three seasons work, when I was stationed in the Manbhum district where, however, I was able to devote considerable time to their study.

The four species referred to are:—

The Indian Long-tailed Nightjar (*Caprimulgus macrourus*)
The Indian Jungle Nightjar (*C. indicus*)
Franklin's Nightjar (*C. monticolus*)
The Common Indian Nightjar (*C. asiaticus*).

All are resident throughout Chota Nagpur: resident in the sense that they breed in every district and are to be met with during the twelve months, though the Long-tailed species and the Jungle Nightjar are seldom seen between October and February. At one time I was of opinion that these two species occurred here only during the breeding season and it was not until the winter of 1935-6, when I paid several visits to the nesting haunts of these birds that I satisfied myself that both the Long-tailed Nightjar and the Jungle Nightjar are to be found regularly, though uncommonly in Chota Nagpur, during the non-nesting months also. It is clear, therefore, that these two species are subject to a general migratory movement, and though Franklin's Nightjar and the Common Indian Nightjar both occur regularly and even fairly frequently during the cold weather months, there can be no doubt that they too migrate; but not in such numbers as do the two first-named species. The fact remains that from February to October the Common Nightjar and Franklin's Nightjar occur in considerable numbers and the other two less frequently, though sufficiently often to be classed as common. The Common Indian Nightjar is the smallest and the

Long-tailed species the largest of the nightjars of which I write. Franklin's Nightjar and the Jungle Nightjar are intermediate in size and of approximately equal measurements. They are about 10½ in. in length, the Common Nightjar 9½ in. and the Long-tailed Nightjar—known of yore as Horsfield's Nightjar—is some three inches longer than this.

These different species of nightjars have their particular haunts. The Common Indian Nightjar occurs in gardens, in the open, on the edge of cultivation, and even in thin scrub. Its favourite nesting site is under a palas (*Butea frondosa*) sapling, in a field strewn with small stones and bordered by light jungle. Franklin's nightjar, on the other hand, I have always found nesting on the hillocks and lower slopes of the higher hills, amongst the medium-sized stones which are a feature of its breeding haunts. The site chosen may be quite open or in the vicinity of scrub, which is another characteristic of these hillocks. The bird is really a denizen of the very *fringes* of forest.

The Jungle Nightjar, as its name implies, takes up its quarters more *inside* the forest, often well within. The jungle, however, must be light in character and of a deciduous nature. In my experience the Jungle Nightjar is not met with in deep forest. The Long-tailed Nightjar, on the other hand usually frequents both thick bush and fairly heavy deciduous and bamboo jungle. It especially favours the banks or the shady, creeper-festooned beds of *nalas* carpeted with dead leaves.

The calls used in the breeding season by these four species of nightjars are distinctive and though it is not possible to identify the birds correctly in the field, it is really quite easy to recognise the species by its call: and let me say at once that the music of the nightjars is well-worth listening to, worth going a long way to hear. It is heard chiefly when dusk deepens into darkness,

'And all the air a solemn stillness holds.'

In the hope that I may be able to convey to the reader some of the joy and thrill I have experienced in listening to Nightjar music, I will quote from my notes written while I was under its spell:—

'It has been a wickedly hot day but now it is pleasantly cool with a gentle breeze blowing. I am seated on a high railway embankment in wild and jungly country. In front of me is a broken open space about three hundred yards long by one hundred yards wide with an outcrop of black rock and just a few bushes and *mhowa* and sal trees; beyond there is rather heavier scrub and deciduous jungle with a *nala* running through it. The water from the nala—when there is any!—passes through a culvert under the embankment where I am seated. Beyond this again, high hills, thickly forested—Jumra to be exact. To right and left of the open space hillocks covered with scrub. Altogether an ideal spot from which to listen to the different nightjars' calls.

It is 5.50. A Peacock has just called from the jungle in front, and a Red Jungle-fowl crowed lustily. Close by a male Robin is singing his jolly jingle.

5.55 and I am startled by a nightjar on my right calling *chwees* on three occasions—startled because I did not expect to hear any nightjar quite so soon. A loud and very penetrating note. The bird was clearly on the wing though I could not spot it. Franklin's Nightjar. Now it is silent and gangmen pass behind me on their way home, their day's work done. Follow several large parrakeets to roost in a small *tope* of trees a mile away, screaming stridently.

6.5. The sun has gone down behind the small hill on the left. More jungle-fowl crowing, followed by the screams of a large flight of green parrakeets and the cachinnating *crescendo* cries of a brain-fever bird. A green barbet also calls from the jungle in front. Dusk is falling fast and the green of the living trees contrasts beautifully with the purple—so it appears in this light—of their sere and leafless neighbours. The silence becomes more intense; but a robin breaks it with its rasping note, and peafowl *mee-ows* in the distance. A single bulbul tinkles tunefully.

6.15. *Chwees* again from the low hilly ground on my right. A small party of green bee-eaters fly across uttering their familiar notes and a green pigeon coos soothingly from somewhere on my left. Now a *'did-you-do-it' pings* piercingly and then flying off gives vent to its usual notes. Obviously some marauding creature has startled it.

6.20. Any minute now I expect to be entertained by the music of the massed bands of the Brigade of Nightjars. Instead a king crow *whippoo-whees* near at hand followed by the green pigeon cooing again but in a much softer key.

Follows a deep silence broken only by the soughing of the wind in the trees.

6.25. *Tuck - tuck - tuck*
Tuck - tuck - tuck - tuck
Tuck - tuck - tuck - tuck - tuck

in the distance, so faint that I can only just hear it. At first it sounds rather like a creaking door being opened and then it somewhat recalls a pebble skimming over ice. Faster and faster come the notes, and though halting in its call at first it now seems as though the bird will never stop. The Jungle Nightjar.

A grey partridge issues its challenge but the predominating call is still that of peafowl although a crow-pheasant is also *whoop - whoop - whooping* and a stone plover delights me with its wild wailing note.

Chwees again, from two different places. One author of these notes flies across, circles and then settles on a largish black stone, spreading its tail a great deal and shuffling from side to side before settling down comfortably. Under the impression that the bird is brooding her young I search for these, but in vain.

Took - took - tookirr-r-r-r.

Took - took - took - tookirr-r-r-r-r, the real pebble over ice this time, right in front of me. The Common Indian Nightjar. Another takes up the refrain and now all three species are calling together from different points of the compass and I don't know which one to tune into so as to give some idea in words of the different calls.

Chwees flies overhead, calling all the time. I watch it settle on the ground, but then it becomes silent.

The ommon Nightjar is going at it hard, but from the ground. Two, often three, and occasionally four *tooks* before the final *irr-r-r-r.*

And now, what I love most of all to hear, the hammer-note. Like a carpenter striking wood, and the strokes are good and hearty and do not stop. *Chonk-chonk-chonk,* deliberate and loud and with a richness of tone that defies description. This is the call of the Long-tailed Nightjar. It seems to be calling from a tree—certainly not while flying.

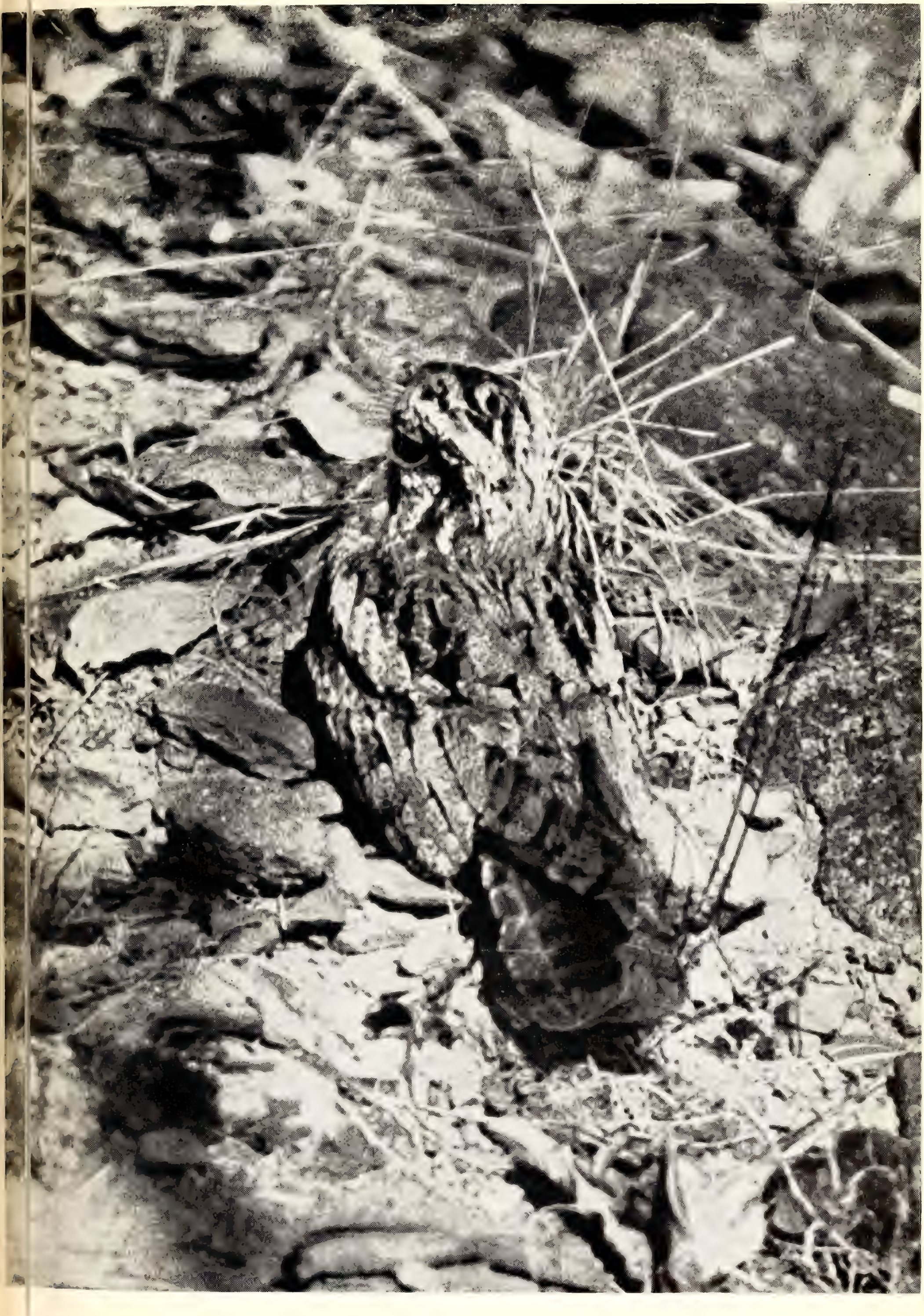
A Franklin's nightjar has settled on the very top of a *mhowa* tree, on an almost perpendicular branch, beautifully silhouetted against the clear sky. It is calling *chwees* repeatedly. Another, also calling, flies within ten feet of my head and although it flip-flaps from side to side and swerves in the usual nightjar-manner, no sound from its wings can I hear.,

6.50, and I can hardly see. Nightjars of all four species calling on every side, Franklin's and the common nightjar predominating. The brain-fever bird still shrieking and any amount of peafowl caterwauling. Unexpectedly a golden-backed woodpecker shrieks, and there is a ring of terror in its notes as though some large owl has seized it.

6.55. The common nightjar's music is dying down but Franklin's nightjar is more in evidence. Only for a short while, however, for now the jungle nightjar's *tuck - tuck - tuck - tuck - tuck* suddenly comes into prominence, followed soon after by the somewhat slower *tuckoo - tuckoo - tuckoo* of the same species. All the notes of this species seem to be uttered from the ground and the number of *tucks* varies greatly; one bird has just *tucked* fifty times or more, calling so fast that it was impossible to count correctly. It sounded much like a horse galloping on a hard road. Is the *tuckoo* note a mating call? there is something warm-blooded, amorous about it which suggests this.

7.10. It is quite dark now and the different nightjars whose notes have each in turn predominated have all stopped calling. The jungle fires on the Jumra range, and on Lugu, behind me, now show up clearly, and the feeling comes over me that it is no longer safe to be out unarmed, that it is time I got back nearer to civilisation. And so the torch is switched on—to lighten our darkness—and I pick my faltering way back to my saloon, my heart overflowing with joy from all I have just heard and seen.'

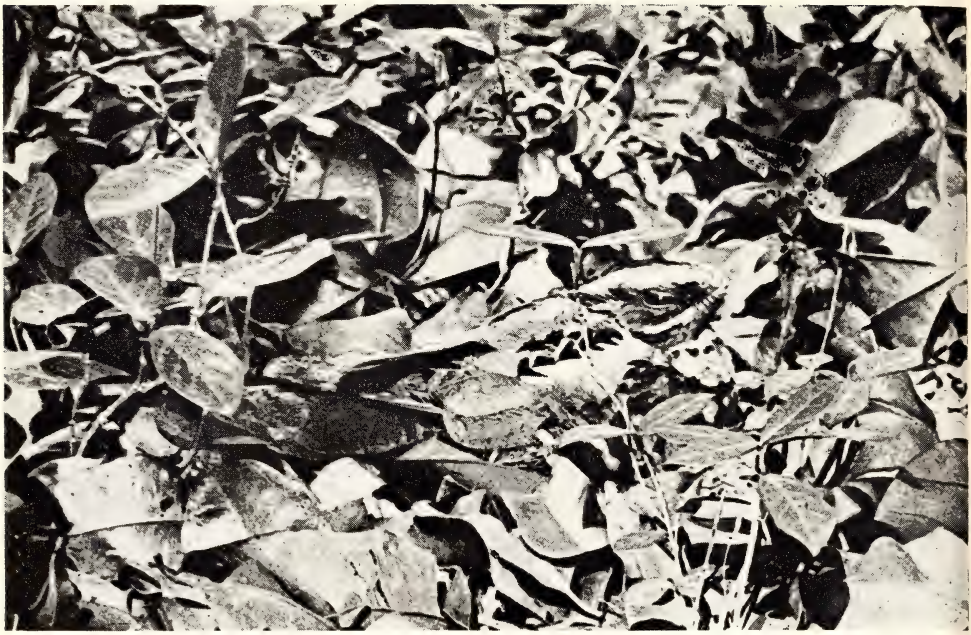
Of course, other notes are also used, perhaps more generally than is imagined. For instance, a common Indian nightjar early one morning after calling in the normal manner treated me for quite ten minutes to a delightfully sweet and musical variation *took - took - terro - oi - ick.* This was in my garden at Dhanbad and since then I have occasionally heard it elsewhere. Again, visits just before dusk to the nesting haunts of long-tailed nightjars have proved to my satisfaction that when this species first leaves its diurnal resting place—and even before—the call commences with a croak rather like a frog's. The note is, however, low and sounds



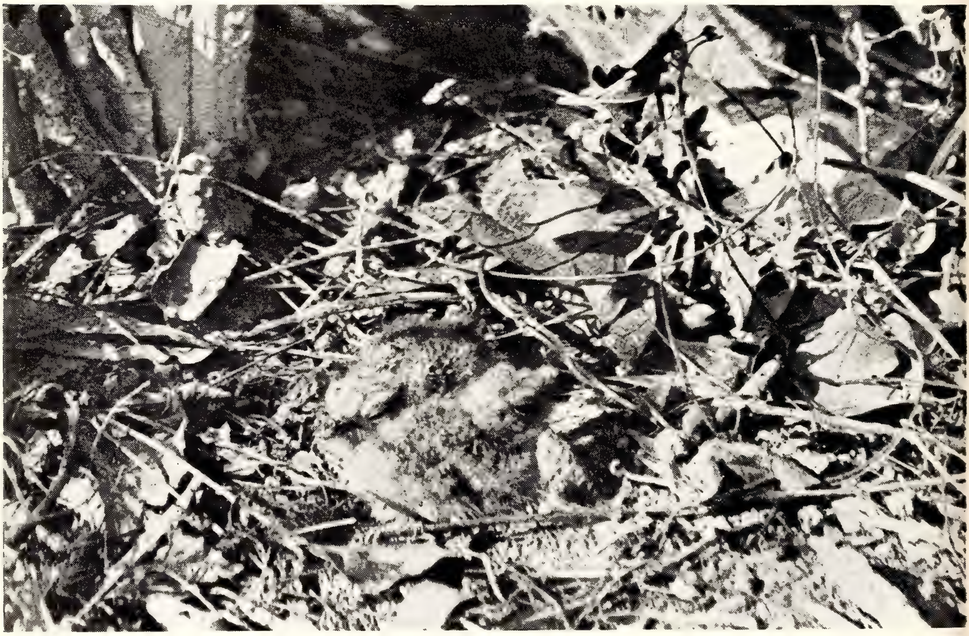
Jungle Nightjar (*Caprimulgus indicus*).

Co ight

Photo by Author.



Camouflage: Common Indian Nightjar brooding, (*C. macrourus*).



Young Common Indian Nightjar.

Copyright *Photos by Author.*

far off. After a short while it changes straight into the usual call which at first is repeated only two or three times. Following a pause the bird *chonks* for two or three minutes with usually three *chonks* to each series and then repeats its note just once or twice for a brief period. Thereafter it usually breaks into sustained calling. It sounds just as though the bird were tuning up and had at last found the right pitch. The Long-tailed Nightjar also occasionally utters another note, a particularly sweet *wog* which must be heard really to be appreciated.

I have never *seen* a jungle nightjar calling so am unable to say definitely whether this species calls from the ground, a post, or tree. Judging from the *direction* of the sound, when I have heard the note at close quarters, I am of opinion it calls *only* from the ground. Franklin's nightjar calls just as frequently while flying as from the ground, or from a post or even tree-top. The Long-tailed Nightjar, on the other hand, utters its normal call only from the ground or a tree, or from a branch low down or one high up. I have heard it use the croaking note when on the wing pursuing another of its species; but this note is generally used while sitting on the ground amidst masses of dead leaves, before taking its first flight of an evening. Sometimes it is uttered from the branch of some stunted tree or thick creeper in the jungle immediately after the day-time roost is left and before it starts calling *chonk*. The Common Indian Nightjar differs from the three preceding species in calling apparently only from the ground, a boulder or even a low post, but *never*, I think, from a tree.

Nightjars start calling about the beginning of February and continue to do so regularly till the middle or end of July, that is to say, during the main breeding season. Thereafter their notes are less in evidence although I have known the Common Indian Nightjar call sporadically till 7th October. This symphony, as I remarked earlier, is to be heard chiefly as dusk is turning to darkness. The different cries are, however, very much in evidence again for an hour or more before dawn breaks and throughout the night when the moon is at her zenith.

Anyone who has examined a nightjar in the flesh must have noticed the very long middle claw, the inner edge of which is serrated and has a comb-like appearance. The use of this pectinated claw still remains a mystery. Long years ago, Gilbert White was of opinion that it helped the bird to deliver food into its enormous mouth, an assertion which as yet has no evidence to support it. Others consider its function is to comb from the stiff bristles of its gape the wings of moths and beetles upon which it feeds. There are objections to this theory. Flycatchers possess similar bristles about the gape, but do not have pectinated claws to clean them, and other species have such a claw but no bristles to wipe. Nevertheless, the explanation is one which has fairly general support. My own contribution to the problem is, I fear, scanty. I have only once seen a Nightjar bring its foot up to its mouth. The impression I then obtained was that the bird was using its claw to remove something from the side of the mouth—it was certainly not to put anything in.

Whistler has stated on more than one occasion that Nightjars cannot travel on foot and asserts that the long central toe prevents progression over the ground. Such a handicap possibly discourages the birds from travelling any great distance in this manner, but it most emphatically does not prevent a nightjar from movement over ground. As a matter of fact, nightjars begin to hop, and even to run, at a very early age. On 14th July 1935, a long-tailed nightjar, I was photographing, settled on a branch of a tree not far from which were her two chicks, the younger not yet forty-eight hours old. Flying down to the ground, she used the croaking note I have already described. Receiving no response from her chicks, she ran four or five feet towards them, her wings erect, their tips nearly meeting over her back. Again she called, and this time both young ones left the spot where they had been born and travelling a distance of quite ten feet finally reached their parent, under whom they took shelter. The larger chick covered the distance by running and hopping, holding up its wings when running in exactly the same manner as the parent bird had done. The smaller chick progressed by hops alone, a couple of inches or so at a time. I have also seen young common Indian nightjars, about a week old, hop in precisely the same manner for double this distance. Again, I once alarmed a Franklin's nightjar which could almost fly. The bird ran in several short bursts with wings upraised while I attempted to catch it.

If young nightjars hop and run well, their parents are even more proficient in progressing over the ground. Nightjars usually alight straight on to their nests. Not uncommonly, however, they settle on the ground some distance away. This may be anything from five to fifteen feet. I once watched from the *hide* a Franklin's nightjar work its way back to the nest from a distance of over fifteen yards. On such occasions the bird progresses either by a series of short runs, with wings carried almost vertically over the body, when it looks for all the world like a sprinter breasting the tape, or the wings may not be lifted at all; or the bird walks a short distance, halts for a space and resumes the journey in a similar manner. The gait then is most peculiar—it is either a waddle like a rook's or a shuffle, as though the bird were wearing a hobbled skirt.[1]

Just as the sight of a *Did-You-Do-It*'s nest containing eggs always thrills me, so too I never tire of watching yet another nightjar sitting on her eggs. How wonderfully the plumage of the bird blends with its surroundings. Let it sit upon a carpet of dead leaves, under a tiny sapling, or in the open surrounded by a few stones, and a stick or two—it does not seem to be a bird at all but part of the ground on which it rests. The illusion is made more perfect by the manner in which the bird rests with

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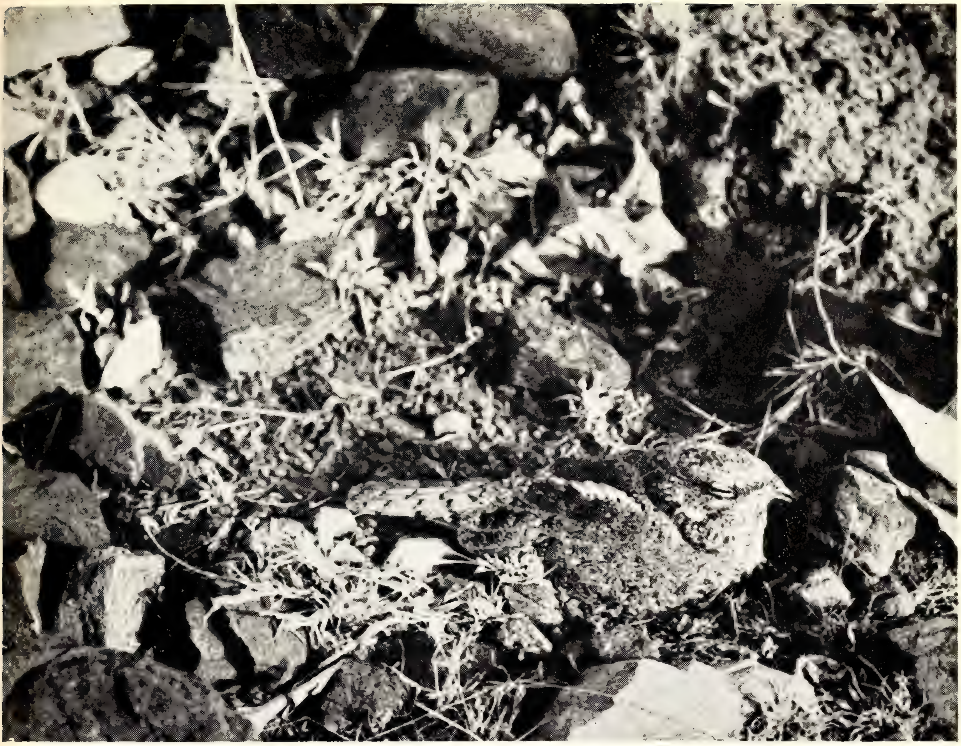
[1] Since I wrote this my attention has been drawn to *The British Bird Book*, vol. 2, p. 374, where, referring to the Nightjar, appears the following statement:—

'Both young and old, it may be added, run easily.'



Franklin's Nightjar (*Caprimulgus monticolus*).

Eggs of Franklin's Nightjar.

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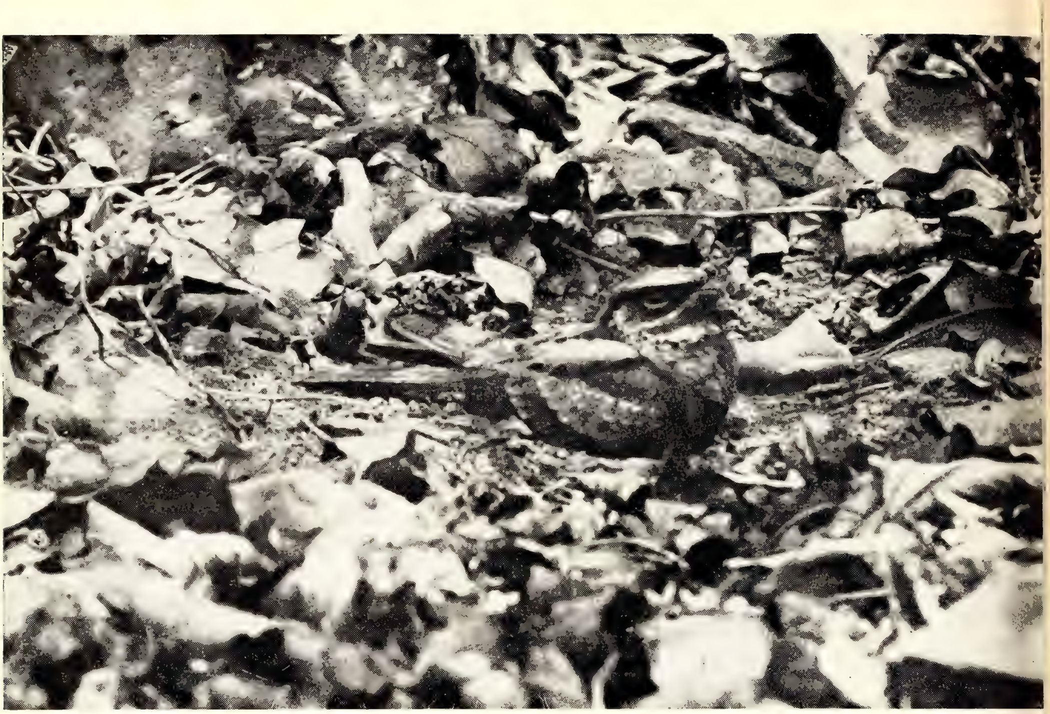
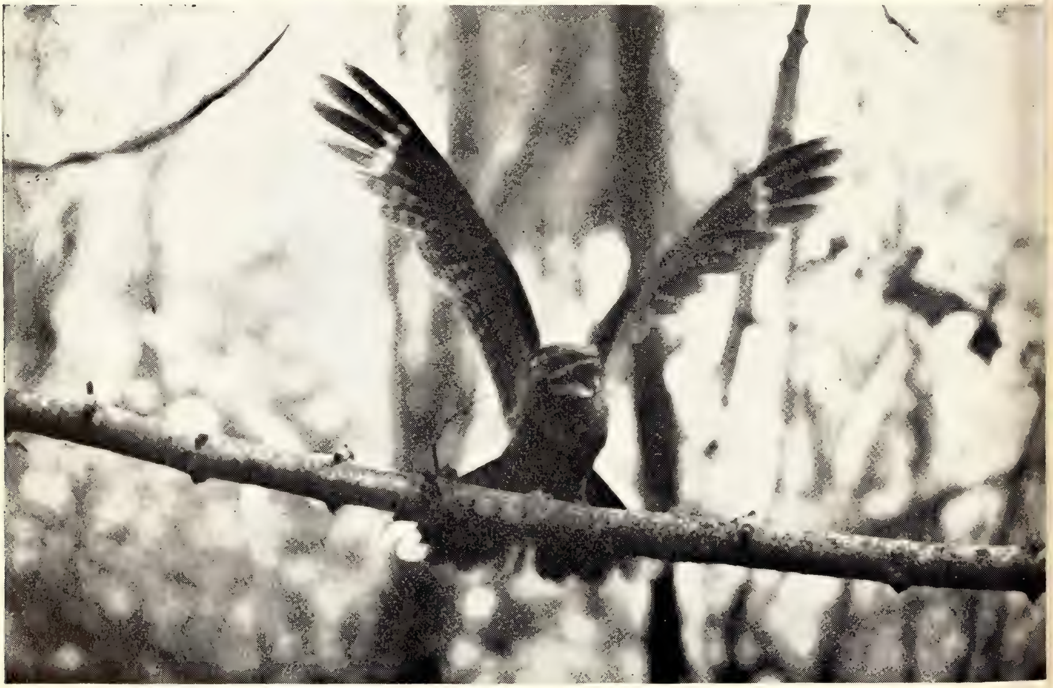
Photos by Author.



Indian Long-tailed Nightjar (*Caprimulgus asiaticus*).



Indian Long-tailed Nightjar.

Copyright *Photos by Autho*

its eyes closed or almost so. Again and again have I shown a nightjar covering her eggs to some friend; always—even when we have been within a few feet of the bird—he or she has taken some time to spot it; and great always has been their wonderment at seeing this perfect example of protective coloration.

The photography of nightjars as a rule presents no difficulties; indeed, the use of the *hide* may generally be dispensed with in the case of the Common Indian Nightjar. Frequently, I have worked my way up slowly to one of these birds as she covered either eggs or young, less than a foot at a time, my head under the focussing cloth and the camera screwed to the tripod, and have so taken all the photographs I wanted. It is, however, terribly hot work and the perspiration has poured down my face until I have literally been blinded and have had to remove my glasses constantly so as to be able to focus correctly. When so occupied, when the tripod will not remain where it is put, when the focussing cloth sags or a high wind causes it constantly to obstruct the view, one's temper runs short, and the language I have then used—well, what else would one expect! In spite, however, of the noise I have then made; in spite also of the camera and tripod falling down within four feet of the sitting bird, either due to my own clumsiness or a gale blowing it over, I have twice known a common Indian nightjar continue to incubate, with eyes still closed, as though nothing untoward had occurred!

I have also photographed Franklin's nightjar without using the *hide*. This, however, has been exceptional. Usually the bird's courage fails it when the photographer is about fifteen feet away, which, of course, is not within camera range. This is probably due to the fact that in Chota Nagpur the species is greatly harassed by the aborigines who kill the bird on every possible occasion. The *modus operandi* being to approach it stealthily from behind and hit it with a slender V-shaped branch on the end of which the foliage still remains. Once alarmed, this species cannot be stalked and recourse will then have to be made to the hiding tent which should be erected some distance away and only moved closer to the nest as the sitting bird becomes used to it. Even when the would-be photographer is safely enclosed—is in *purdah,* as an Indian friend once expressed it—a considerable interval will most certainly elapse before a natural portrait can be secured, due either to the bird sitting unnaturally—eyes wide open and bolt upright—the skin under the chin vibrating at an alarming rate a sure sign that the bird is frightened or suspicious.

There is one feature of an incubating Franklin's Nightjar that at once distinguishes it from the other species with which this article deals—this is the buff-coloured V which extends roughly from the shoulders to half way down the back. It is strange that no observer should have drawn attention to this marking which is partly brought out in the accompanying plate.

I have found remarkably few nests of the Jungle Nightjar considering the numbers of this species which are to be heard throughout the Chota Nagpur Division. Whether this has been due to my keeping one eye open to the possibilities of a Russell's

Viper—habitat Manbhum, if the famous 'Tiger' Knowles is to be believed—or whether my failure was attributable to inertia brought on by the terrific heat, to which advancing years made me more susceptible than was the case a decade previously, I cannot say. The fact remains that I always found this species very quick to leave its eggs, once it knew they had been spotted, and equally loth to return to them. There can be no doubt that, here again, this is due to the manner in which the aborigines harass and destroy this species when incubating. Two cases immediately come to mind of scattered feathers and broken shells where only the day before I had gazed with admiration and joy on a Jungle Nightjar incubating its two eggs.

I did not succeed in finding the eggs of the Long-tailed Nightjar until the summer of 1935; this was entirely due to my searching for them previously in scrub or thin jungle. When, however, I started looking for them in deeper forest round about the *nala* beds, I was immediately successful. The eggs of this bird are appreciably larger than those of the other nightjars and are in addition differently coloured, their ground colour being of a creamy hue in contrast to the salmon-pink of the other species.

The *New Fauna*[1] states that the Long-tailed Nightjar is 'an exceptionally confiding, tame bird'. This may be the case in Assam, but it was not long before I was disillusioned with regard to residents in the Manbhum district. Why they should be so very shy here is beyond my ken because, when breeding, the species is free from the attentions of the local savage who, I discovered in due course, is not aware that nightjars breed in such heavy jungle. Be the reason what it may I was soon to learn that in these parts *albononotus* invariably leaves its eggs or callow young when the intruder is fifteen feet or more distant from its treasures, and, although it will then return to them, he can be certain that the third time he goes to investigate affairs he will find the eggs lying deserted in the so-called nest, or the young removed—may be they are enticed away—so that it is almost hopeless to expect to see them again. Such shyness on the bird's part seemed to put its photography beyond the realms of possibility. However, it is an occasion such as this which brings out the best in the really keen bird photographer and observation indicated that success could only come my way if I refrained from flushing a bird off its eggs a second time, observing it instead from a distance through the glasses until I was satisfied that the young had made their appearance. Pursuing these tactics I eventually—after several failures—succeeded in photographing the Long-tailed Nightjar at home when her eggs were actually hatching. The jungle, however, was heavy and the light consequently poor, necessitating, of course, the use of a large stop so that the resultant pictures lack that detail I should like to see. I believe that this particular bird would have permitted me to expose all twelve plates on her that morning. Alas! when pulling the roller-blind chord preparatory to taking the third photograph the

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[1] Vol. iv, p. 365.

Thornton-Pickard shutter broke and, as usual on such occasions, there was nothing I could do to remedy matters for the nonce. I therefore dismantled the hiding tent and camera just where they stood, the bird making no attempt to leave the eggs. Then did I ask myself on whose unlucky countenance had I gazed when I first awakened that morning; and when I put the same question to my *shikari* he supplied the reason for our bad luck. When he came out of his hut that morning he had happened on an old woman who always brought him ill fortune; he had intended to tell me earlier about this dreadful calamity but finally decided to keep silent on the point lest I should rate him for a superstitious old fool. But now he was convinced; and so on, until I bade him shut up. Of course, when I returned four days later, it was to find that the young ones had been removed, where I knew not.

I have succeeded in photographing only one other long-tailed nightjar. Here again the conditions were just the same as before, except that in this instance the photographs I succeeded in taking of the parent bird covering its young will not permit of reproduction owing to the way in which sunshine and shadow alternate on the bird's back. Fortune however favoured me, as during the next two days when the young were very small, the long-tailed nightjar almost invariably alighted on a branch a few feet from the nest thus enabling me to take a number of pictures showing the bird's long wings and white markings on the primaries, one of these is reproduced herewith.

In suitable places the Manbhum district is a veritable paradise for nightjars. How common the genus is may perhaps be gathered from the following statement of fact. When first I made Sukroo's acquaintance I was anxious to obtain some photos of a Nightjar —did he know the bird and had he ever found its eggs? Yes, he was familiar with the *chuckoo* and had often found its eggs and young. Thinking to put him on his mettle I wagered him a rupee that he could not find me twelve nightjars' nests that day. Although I felt rather guilty of betting on what I considered was a certainty—if there is such a thing—I nevertheless lost the bet !

NOTES ON SOME BIRDS RECORDED FROM BURMA.

BY

P. F. GARTHWAITE, B.F.S.

assisted by

DR. C. B. TICEHURST, M.A., M.R.C.S., M.B.O.U.

The following notes refer to birds collected by the writer in various localities in Burma from 1932 to 1935. In every case the identification has been made or verified by Dr. C. B. Ticehurst, M.A., M.B.O.U., to whom the writer is greatly indebted for constant help. The nomenclature adopted is based on that of the *Fauna of British India*, 2nd Edition (referred to hereafter as *F.B.I.*) and the notes made are only those which it is thought expand the present scope of the *F.B.I.*, particularly as regards distribution. The attached map shows the position of localities from which birds referred to were collected. All these birds were collected in the plains or foothills below 2,000 ft. Dr. C. B. Ticehurst is responsible for the identification and systematic notes, and his contribution is added in brackets.

[**Garrulax leucolophus hardwickii.**

Garrulax leucolophus belangeri. The Burmese White-crested Laughing Thrush.

In the Bulletin of the *B.O.C.* (vol. xlvi, p. 113) I described *Garrulax leucolophus hardwickii* from the Naga Hills and gave as its rough distribution Assam and N. Burma. This form was added in the addenda of the *F.B.I.* (vol. viii, p. 599) but the distribution given there was *Garhwal* and N.-W. Himalayas. We are now in a position to detail the ranges of these two forms more accurately than has been done before.

G. l. hardwickii in Burma occupies the Kachin Hills in the North, and even occurs there as low as 100 ft.; the small ranges of Gangaw and Mingin in the Katha and Shwebo Districts; Mogok 4,400 ft.; has been recorded (as *leucolophus*) on the borders of N. Shan States and Yunnan (Malipa); the Chin Hills and the outliers between the main range and the Chindwin river (Pondaung Range); Arakan Yomas.

G. l. belangeri.—From Tavoy in Tenasserim northwards in lower hills 300-1,000 ft. or plains i.e., S. Shan States where it is said to go not higher than 2,800 ft.; Pegu, Rangoon, Bassein, Tharrawaddy, Prome, Toungoo, Pyinmana, it extends north along the foothills east of the Irrawaddy in the Maymyo Mogok divisions to 23° N., the higher hills here being inhabited by *hardwickii.*]

[**Pomatorhinus schisticeps nuchalis.** Tweeddale's Scimitar Babbler.

Pomatorhinus schisticeps mearsi. Grant's Slaty-headed Scimitar Babbler.

Pomatorhinus olivaceus ripponi. Harington's Shan Scimitar Babbler.

These three birds call for some comment for various reasons.

Firstly, the *F.B.I.* puts *nuchalis* as a species but I think it may well be a race of *schisticeps* for the following reasons:—

From Arakan, Chin Hills east to the Irrawaddy river the form is undoubtedly *mearsi*, but a bird from Chaungzon Shwebo is exactly intermediate; it has the white streaks in the side of the breast of *mearsi*, but in size is *nuchalis*; on the east side of the Irrawaddy *nuchalis* is the representative.

Secondly, it is tempting to put *olivaceus ripponi* as a further race of *schisticeps* and this has been done by some authors. The chief differences are the smaller size, shorter bill and lack of chestnut feathers in the flanks. In favour of this is the fact that birds from Maymyo are intermediate in the question of the flank feathers, that is to say the chestnut colour is not nearly so marked as in typical *nuchalis* and indeed some are quite like *ripponi* in this respect but in size are *nuchalis*. But against this arrangement we certainly have *nuchalis* and *ripponi* in Mogok district and apparently at Bampon and Kalaw and probably elsewhere in Southern Shan States. Moreover *olivaceus olivaceus* occurs together with *nuchalis* at Thongyat, N. Tennasserim. It must be noted that the birds from Mogok were obtained at different elevations 300 and 3,700 and so the possibility that one (*olivaceus*) is a bird of higher elevation must not be lost sight of; where the two forms have elsewhere been obtained in the same locality details are not sufficient to say whether there was an altitudinal difference or not.

It is a point which collectors would do well to take note of.

Thirdly, many of the measurements given in *F.B.I.* are not correct. I have measured every bird in the British Museum and many more besides and I find the following measurements.

Mearsi. Wing 102-112 mm., tail 105-116 mm., bill from skull 34.5-38 mm.

Nuchalis. Wing 88-102 mm., tail 92-103 mm., bill 27-32 mm.

In *F.B.I.*, the wing measurements as given 87-91 can only apply to the smallest: the tail, as given, 210-220 mm. and corrected in vol. xiii, to 110-120 is very wide of the mark.

Ripponi. Wing 82.5-90 mm., tail 88-97 mm., bill 23.5-26 mm.]

Gampsorhynchus rufulus rufulus (232). The White-headed Shrike-Babbler.

One specimen, May 1935, Nanhlaing Reserve, Shwebo Forest Division.

Three specimens, January 1936, Namma Reserve, Bhamo Forest Division.

The bird shot in the Shwebo Division had legs fleshy white, of a bluish tinge, a characteristic according to the *F.B.I.* of the Southern *G. r. torquatus* whose distribution is given as 'The Toungoo Hills and Karenni to Tenasserim', while the distribution of the Northern race is given as 'Chin Hills and Arakan'.

Both localities from which this bird was collected are heavily wooded, containing evergreen forest in the foothills, with hills rising above 4,000 ft. behind them.

(This race has been recorded by Harington from the Jade Mines, Myitkyina District, and from the foothills of the Henzada Yomas by Mr. Stanford.)

Napothera brevicaudatus venningi. Venning's Wren-Babbler.

One specimen from Gokteik, Hsaipaw North Shan States.

(Although this distribution in the *F.B.I.* is given as South Shan States, Burma and Yunnan, there are no specimens in the British Museum, nor are there any records from any part of Burma except the South Shah States.)

Stachyridopsis rufifrons rufifrons (279). Hume's Babbler.

Five specimens, March 1935, Thogale, South Toungoo Forest Division.

Two specimens, August 1935, Nanhlaing Reserve, Shwebo Forest Division.

One specimen, November 1935, Thogale; one Monhnit, Pyinmana, December 1935.

The birds obtained in March at Thogale appeared to be breeding, as nesting material was observed to be taken by them, but no nests were found. The *F.B.I.* gives the distribution as 'Shan States of Tenasserim' but these records prove a more westerly range. Thogale is on the eastern slopes of the Pegu Yomas where there is abundant evergreen vegetation.

[Though this is probably not a rare bird, yet very few specimens have hitherto been obtained. The distribution is far from being worked out at present, but it certainly occurs also on the west of the Pegu Yomas (whence came the type in Lat. 19) and Mr. Smith has obtained it there also in the Yetho Yomas, Tharrawaddy Forest Division.]

Criniger tephrogenys griseiceps (382). Hume's White-throated Bulbul.

Seven birds from the Thogale locality, South Toungoo Forest Division, and two from the Kaing Reserve, Pyinmana Division.

Both localities are humid, well-wooded, with abundant ever-green forest, and the bird is found in small parties in the densest undergrowth.

(In the *Journal*, vol. xxxvi, 925, I pointed out that Oates obtained five specimens of this bird in the E. Pegu Hills in the seventies of last century and that no one since had met with it. It is, therefore, of considerable interest to find that Mr. Garthwaite has re-discovered this bird in the same range as Oates originally found it. Oates said it occurred as far north as the latitude of Thayetmyo. Mr. Garthwaite has extended it a little farther north to the Kaing Reserve in Pyinmana Division. The distributions of *Criniger* species and races in Burma need far more attention before their distributions and relationships can be satisfactorily made out. The parts which need most attention are the hills on east side of the Sittang river and southwards to the Amherst District.)

Criniger flaveolus flaveolus (380). The Indian White-throated Bulbul.

One specimen, August 1934, Nanhlaing Reserve, Shwebo Forest Division.
One specimen, May 1935, Pile Reserve, West Katha Forest Division.
One specimen, January 1936, Sinkan Reserve, Bhamo Forest Division.

These three skins agreed with none of the descriptions in the *F.B.I.*, of birds said to occur in Burma, and were identified by Dr. Ticehurst as this race, for which Burma is not included in the distribution given in the *F.B.I.*

[I have already (*Journ. Bom. Nat. Hist., Soc.*, xxxvi, pp. 423-4) pointed out that *Criniger gularis* (Horsf.) is preoccupied and cannot be used for the Indian bird which I have previously recorded from Arakan and the Katha District.]

Iole virescens virescens. The Olive Bulbul.

Iole virescens propinqua.

Various specimens of this species from Kaing Reserve, Pyinmana, Satchaung, S. Toungoo, Gwethe Reserve, N. Toungoo, Pile, Katha, Gangaw, Maymyo; Simaw Reserve Bhamo.

[The type of *Iole virescens virescens* came from Arakan, and these birds from N. and S. Toungoo Divisions and from Pyinmana are *virescens* or nearest that form; the birds from Katha, Maymyo and Bhamo are clearly not the same race; they are larger and have darker, cinnamon undertail coverts and I place them with *propinqua* which has already been recorded from the Myitkyina District (*Ibis* 1935, p. 249). The bird from Gangaw is also nearest to *propinqua*.

Bingham obtained this form in Mong Kong, Shan States (specimen examined in British Museum).

With a widely distributed species such as this there must naturally be intergrades between *virescens* and *propinqua* in Burma.]

Larvivora cyane (483). The Siberian Blue Chat.

Five specimens from Gangaw, Yaw Forest Division in February 1934.
One specimen from Thogale, South Toungoo Forest Division in March 1935.
One specimen from Gwethe Reserve, North Toungoo Forest Division in November 1935.
One specimen from Kaing Reserve, Pyinmana Forest Division in December 1935.

Gangaw is on the east bank of the Myittha river at the foot of the Chin Hills, which rise up from the west bank.

This migrant has previously only rarely been recorded from Burma, but these collections show that it is widely spread over the country in the winter months. It was found in Bamboo jungle, scratching about in dead leaves on the ground, and often met with on sandy paths.

(Though the distribution in the *F.B.I.* is given as 'Burma' it has only been recorded from Pegu once; Thandaung, Toungoo once; and Southern Shan States once. In Tenasserim it was recorded as common by Davison and Bingham.)

Rhodophila ferrea ferrea. The Western Dark Grey Bush-chat.

Specimens from Maymyo, Pyinmana and S. Toungoo in winter.

[In the *Journal* (vol. xxxvii, p. 357) Mr. Kinnear says he can see no difference in winter plumage between *ferrea* and *haringtoni*. With this I agree; all the Burmese birds I have seen seem quite the same as Himalayan ones. Hartert in his description of *haringtoni* stressed the shortness of the tail, the measurements for which he gives as 57-61.5 mm. Kinnear gives for *ferrea* 59-65 mm. Seventeen males from Burma in winter measure:—Tail 59-68 mm.—and I must therefore place them with the typical race.]

Luscinia obscura.

Shot in January 1936 in the Simaw Reserve, Bhamo Forest Division about 500 ft. above sea level. The bird was seen in thick undergrowth on the side of a stream, and the tail was unfortunately damaged in shooting. The locality is at the foot of the high mountains which run into the Sinlum range. Only the one bird was seen.

[This is a remarkable addition to the Burmese Fauna. Very little is known about this species which breeds in S.-W. Kansu and in the Tsin-ling Range. In the former place Beresouski discovered it originally and Owstroi's Japanese collectors found it in the latter, and beyond a few (?) specimens in Russian Museums there appear to be four adult males only in the Tring collection. To the kindness of Dr. Mayr of the American Museum of Natural History the satisfactory determination of this specimen is due, as there is no specimen of *Luscinia obscura* in the British Museum. He informs me that as the females in this genus have the upper parts brown and that as in this specimen the upper parts are slate-blue, as in the adult males, he considers it to be a male in the first year, and in a plumage which is unknown.

This is very likely to be so, assuming of course that there is no distinctive breeding dress. The adult male in summer has a black chin throat and breast, whether this is retained in winter is not known.]

The following is a description of this bird.

Luscinia (*larvivora*) *obscura*. Presumed male in first winter.

Upper parts near dusky slate blue (*Ridgway* xliii, m) lores and malar streak black; earcoverts and indistinct supercilium ochraceous grey; chin and centre of belly whitish; rest of under parts with axillaries and under-wing dull pale ochraceous with indication of 'scalloping' due to faint dark edges; flanks tinged with olivaceous; thighs blackish; wings black edged with colour of mantle on tertiaries and coverts. Tail missing.

Wing 69.5, tail ?, bill 16 from skull, tarsus 27.

Second primary between seventh and eighth.

Dr. Mayr informs me that the measurements and structure of wing and bill closely correspond with males from the Tsinling Mountains, and suggests that the black malar streak foreshadows the black shield of the adult. He further points out that one of the adult males in the Tring collection has one ochraceous feather in the black shield similar to those on the breast of this specimen.]

Monticola solitarius pandoo. The Indian Blue Rock-Thrush.

I obtained several Blue Rock Thrushes at Gangaw in the winter and one from Pyinmana, which have been identified as belonging to this race.

[The *F.B.I.* says possibly this form winters in North Burma. Mr. Stanford has already recorded it from Myitkyina and Mr. Garthwaite's specimens now show that it is much more widely spread.]

Seicercus cantator (895). Tickell's Flycatcher Warbler.

Two specimens from Baw Reserve, Maymyo Forest Division, December 1934.
One specimen from Kaing Reserve, Pyinmana Forest Division, December 1934.
One specimen from Simaw Reserve, Bhamo Forest Division, January 1936.

Previous records of this bird are rare and its distribution in Burma is given in the *F.B.I.* as 'Chin Hills' and 'Karen Hills'. These three records are, however, widespread, and are all from the foothills below 1,000 ft.

(Beyond the statement in the *F.B.I.* that this occurs in the Chin Hills I know of no record thence. Oates in the *Birds of British Burma* gave near Toungoo in the Karen Hills, where Wardlaw-Ramsay had met it, and nowhere else. In the British Museum the only Burmese specimen is one of Wardlaw-Ramsay's from this locality and Walden describes it as a new bird, *Abrornis chrysea*. This species doubtless has been and is largely overlooked. Burmese birds do not appear to be any different to those from Sikkim.)

Æthiopsar grandis. } The Jungle Myna. One specimen from Katha.
Æthiopsar fuscus. } Four specimens from Pyinmana.

The *F.B.I.* gives the distribution of *fuscus* as the whole of Burma to Rangoon and of *fuscus torquatus* as Peninsula of Burma and Siam.

As regards *fuscus* I do not think this distribution can be correct. The farthest north in Burma from which I have seen specimens is from Pyinmana but there are records from *Myingyan,* yet the districts round Shwebo, Maymyo and Myitkyina in Upper Burma have been intensively worked by Messrs. Stanford, Smith and Garthwaite for some years now without a single specimen being obtained. There are eight records of it from the Chin Hills, Arakan and Southern Shan States but there are no specimens thence in the British Museum. The distribution leaves one in doubt as to which form is found in N. Tenasserim where the bird is evidently very common. I have examined a number of birds from Tenasserim and I cannot see that they differ from those from the rest of Burma or from those of Northern India.

Series from Sikkim Bengal, wing 120-127.5 mm.

Series from Tenasserim, wing 120-126 mm.

Series from Malay Peninsula, wing, 118-134 mm.

Series from Burma (lower), wing 120-128, 130, 133 mm.

The Malay bird (*torquatus*) was described from Pahang and is said to be smaller. I do not feel convinced that there is any colour difference between *torquatus* and *fuscus* and on a series only 5 out of 13 are a trifle smaller than Indian birds. It has no place in the Burmese avifauna.

Fuscus extends from India through Dacca, Tipperah and Mymensing to E. Assam (but not to Manipur) and then it is seemingly distributed through Arakan (Hopwood) and the plains of Lower Burma from Pyinmana south and throughout Tenasserim (but not in the hills between Tavoy and Siam) to the Malay Peninsula.

The *F.B.I.* divides *grandis* into two forms *grandis grandis* from the S.-W. Burma and E. Burma, South Shan States and Karenni South to Tenasserim and *grandis infuscatus* from N. Burma and Arakan, Manipur, Eastern Assam and Assam, south of the Brahmaputra. I have examined all the material in the British Museum and this does not bear out the distribution as given above. There are no specimens from Assam, and from Manipur only from the south and south-east; there are no specimens from S.-W. Burma. I find that in Burma it occurs in the North in Myitkyina, Bhamo, Katha, Mogok, Maymyo, Upper and Lower Chindwin Districts as far as Mingin; in Karenni and Southern Shan States; from Tenasserim there are two specimens said to have been taken on the Tenasserim river, that is in the hills which divide Tavoy from Siam. Hume particularly stressed that they were *said* to have been taken there; the labels are not those of the original collector and Davison never met with the species in Tenasserim, nor did Willoughby Lowe. So the fixation of the type locality for *grandis* as Tenasserim was not a very happy one. Outside Burma it extends through Siam to French Indo-China.

Birds from Upper Burma, including the Chindwin whence came the type of *infuscatus*, do not seem to me to be different to those from the Tenasserim river and Siam. The differences relied on are partly due to individual variation and partly due to wear.

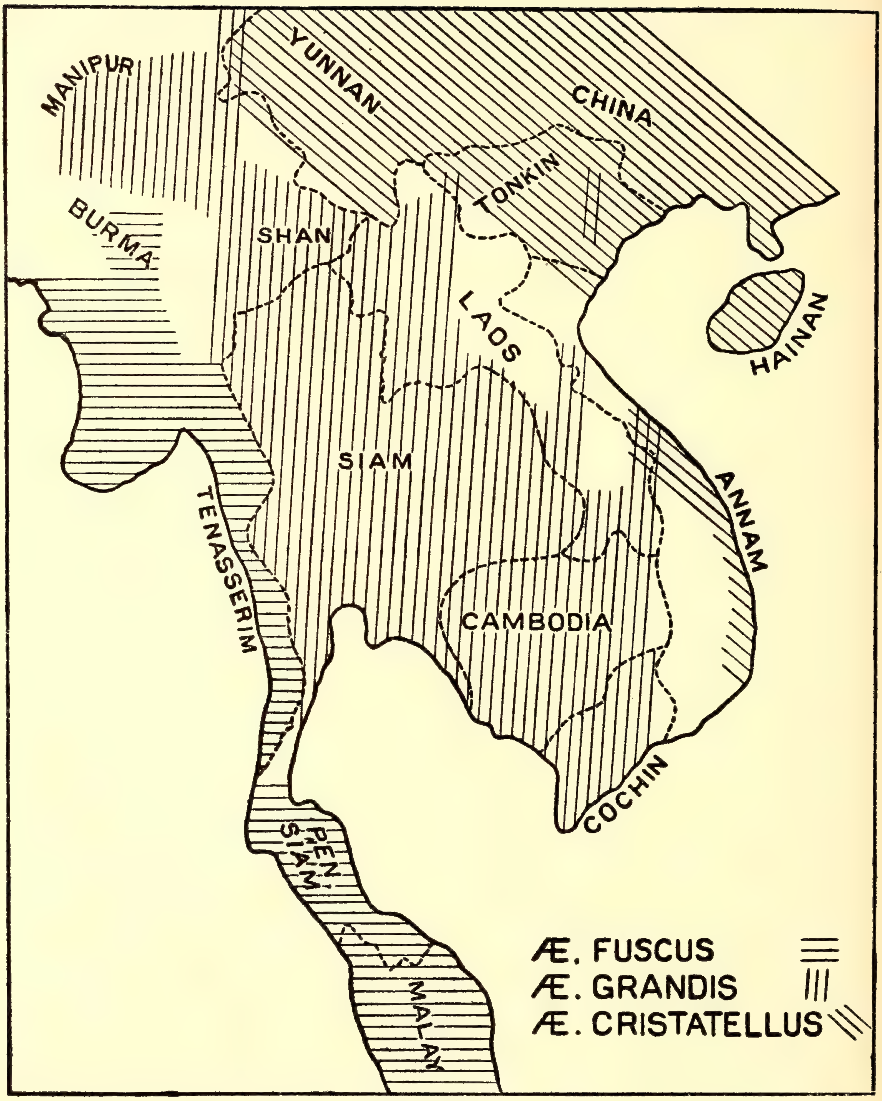
I regard *infuscatus* as a synonym of *grandis*.

Series measured, wing 128-146 mm.

The question then arises—what is the relation between *grandis* and *fuscus*. From the distribution of these two which I have given above it appears that *grandis* and *fuscus* do not occur anywhere together. It is true there are eight records of *fuscus* in the Chin Hills and Shan States and of *grandis* in N. Tenasserim at Kawkariyet (where only *fuscus* has been obtained) but until specimens are forthcoming to prove that the two forms occur together I think we must accept the fact that, so far as is known, they do not do so.

As bearing on this point a series of hides obtained in the foothills of the Maymyo District 300-500 ft. by Messrs. Smith and Garthwaite are instructive. One specimen is indistinguishable from *grandis*, two are nearer *grandis* than they are *fuscus* and two I can only consider to be intergrades between *grandis* and *fuscus*; these have the dark mark at the base of the lower mandible indicated, but not perhaps quite so marked as in *fuscus*, the colour of the upper and underparts are dark for *fuscus* and pale for *grandis*, the upper parts being distinctly paler than the crown (in *grandis* crown and upper parts concolourous); in size they might pass for *grandis* and are large for *fuscus* wing 130-36. In this connection too, it may be noted that the largest *fuscus* of any came from Pyinmana, wing 128, 130, 133—larger than any others I have measured, but in every other character these birds are typical *fuscus*. Between Pyinmana and Maymyo there are no specimens available of any form.

The evidence, then, so far as I have been able to gather it, is that *fuscus* and *grandis* do not occur in the same area and that in the foothills


MANIPUR
YUNNAN
CHINA
TONKIN
BURMA
SHAN
LAOS
HAINAN
SIAM
ANNAM
TENASSERIM
CAMBODIA
COCHIN
PEN. SIAM
MALAY
Æ. FUSCUS
Æ. GRANDIS
Æ. CRISTATELLUS

Map to show roughly the distribution of *Æthiopsar cristatellus, grandis* and *fuscus*. To show overlap of *cristatellus* and *grandis* and meeting ground of *grandis* and *fuscus*.

between Mandalay and Maymyo there is some evidence of intergradation between the two; the two must, therefore, be considered to be conspecific.

A further question arises as to whether *cristatellus* is conspecific with *fuscus* and *grandis*. Besides the rather duller plumage *cristatellus* differs from *grandis* in having the under-tail coverts black with narrow white tips and *narrower* white tips to the tail. I may here remark that in N. Burma *grandis* sometimes has the undertail coverts partly black, but always with broad white tips and broad white tips to the tail. *Cristatellus* occurs throughout South China to Szechwan and is represented in French Indo-China by a slightly smaller form (*brevipennis*). From the rather extensive material in the British Museum and from M. Delacour's record (Les oiseaux de l' Indochine française) it appears that *cristatellus* is the bird of Tonkin and the sea bird of Annam south to Phan Rang. The rest of Indo-China and Siam, west to the Shan States and Karenni is inhabited by *grandis*. But *grandis* also occurs in at least two places in Tonkin (Long Son and Laichan) side by side with *cristatellus* and also on the Annam coast in the neighbourhood of Vinh, Guantu and Hué'. Birds from these places are clearly one or the other of these forms and no intergrades have been found. Moreover, Delacour indicates rather different habits, and so although there is another whole geographical replacement between *cristatellus* and *grandis* the evidence at present is that they behave as species which replace one another.

Furthermore, in N.-W. Yunnan both occur. Rothschild (*Nov. Zool.*, xxxiii, p. 339) records *grandis* from Muanghu and from the hills N.-W. of Tengyueh (Momien) and *cristatellus* from the latter place and from Malipa in N. Hsenwi, N. Shan States, close to the Yunnan boundary, on the authority of Bangs (Andrews-Heller coll.). Presumably this bird from Malipa has been correctly identified and so *cristatellus* should be included in the Burmese avifauna, though it is omitted in the *F.B.I.* In the rest of Yunnan (Lichiang Range, Yoaknan, Hsiao and Mengtze) *cristatellus* only is recorded.

There seem to have been several mistakes made in the names of the Jungle Mynah, which date back to Horsfield and Moore's Catalogue 1858. The first name proposed was *Pastor griseus* Horsfield (*Trans. Linn. Soc.*, xiii, p. 154, 1820) for the Javan Crested Mynah. This name in the above Catalogue was set aside because Daudin in 1800 (*Orn.* ii, p. 286) used *Gracula grisea* as a new name for Latham's *Turdus ginginianus* (*Acridotheres ginginianus*). Moore was correct in doing this because he put the Jungle Mynahs in the same genus, *Acridotheres*, as the Common and Bank Mynahs. If, however, as Oates did in 1889, the Jungle Mynahs are remvoed to the genus *Æthiopsar* then *Pastor griseus* is not preoccupied by *Gracula grisea* and becomes the oldest name, for the bird usually known as *Æthiopsar javanicus*. *Æthiopsar grandis grandis*, *F.B.I.* could not be the correct name since *grandis* (1858) is only a race of *javanicus* (1850); the name used should have been *Æthiopsar javanicus grandis*; for this reason, too, Chasen's *Æthiopsar grandis javanicus* is equally incorrect (Hand-list of Malaysian Birds.)

The eastern forms then will stand as

Aethiopsar griseus griseus (Horsf.) *Trans. Linn. Soc.*, xiii, p. 154. 1820—Java.

Aethiopsar griseus grandis (Horsfield and Moore) *Cat. B. Mus.* East India Coy., p. 537. 1858 Sumatra (in error = Tenasserim).

Aethiopsar griseus fuscus (Wagler) *Syst. Av. Pastor* sp., 6, 1827 India—E. Bengal.

and

Aethiopsar cristatellus cristatellus

Aethiopsar cristatellus brevipennis Hartert *Nov. Zool.*, xxii, p. 250. 1910—Hainan.

Munia punctulata lineoventer. The Spotted Munia.

Specimens from Maymyo and Katha.

[In the *F.B.I.* the type locality of *punctulata* is given as Calcutta. Linnaeus' name is based on Edwards' pl. 40 of the Natural History and Edwards said it came from the West Indies where it was sold for a Gowry (Cowry). From this it seems unlikely that the bird came from Calcutta and Edwards' plate does not represent the Indian bird. However, Gmelin in 1789 fixed on Java as the type locality and this can be accepted. The Indian bird should be called *Munia punctulata lineoventer* Hodgs. A race *subundulata* was described from Manipur but many Assam and Burmese birds are indistinguishable from

Indian ones and all seem to be nearer *lineoventer* than to *topela* (Amoy). There is a good deal of individual variation to be seen in birds from Burma and no doubt the form here is an emotable intergrade which hardly merits recognition.]

[**Anthus spinoletta coutellii.** The Egyptian Water Pipit

Anthus spinoletta japonicus. The Japanese Water Pipit.

Alauda arvensis japonica. The Japanese Sky-Lark.

In the *F.B.I.* it is recorded that there is a specimen of *Anthus coutellii* from Burma in the British Museum. I have searched in vain for this specimen and from the distribution of this form it is exceedingly unlikely to occur in Burma. Under *japonicus* it is recorded in the *F.B.I.* that Oates identified two birds trapped in their nests on Mount Victoria as being of this race, and that the skins cannot now be traced. Further, Burma is included in the winter range of this bird. I can find no evidence for that statement. There are no specimens of *japonicus* from Burma in the British Museum.

Under *Alauda arvensis japonica* Oates is credited with having identified a bird of this form which had been shot off its nest on Mount Victoria. This specimen Mr. Baker considered to be *coelivox*.

It will be observed that Oates is said to have identified breeding birds of *Anthus japonicus* and of *Alauda japonica* from Mount Victoria. I feel quite sure that a muddle has occurred; the specimens of *Anthus japonicus* are not forthcoming, but in the British Museum there are two specimens of an *Alauda* taken by Col. Rippon on Mount Victoria on 19-4-04 and 25-3-04 which he identified as *arvensis*. On the labels *arvensis* was scratched out and *japonicus* inserted by Oates. I believe these specimens to have done duty for the records of both species.

[These skylarks from Mount Victoria I certainly think are not *japonica,* nor *coelivox,* but are *Alauda gulgula weigoldi* which occurs in Szechwan, S.-E. Tibet and N. Yunnan. It is more rusty and darker than *coelivox*.]

Anthreptes macularia macularia (1288). The Banded Sunbird.

One specimen in January 1936 from Simaw Reserve, Bhamo Forest Division.

The bird was shot on the bank of a stream in thick evergreen jungle. The distribution is given in the *F.B.I.* as 'Western Burma from Akyab to Tenasserim'; but this record and also one of H. C. Smith from the Maymyo Forest Division shows that it occurs in North Eastern Burma.

[This is the bird at one time known as *Anthreptes hypogrammica* and *A. nuchalis*. Though the distribution in the *F.B.I.* is as given above it does not seem to be based on records or specimens. In the British Museum there are a few specimens from South Tenasserim only and I cannot find that it has been recorded by anyone since Oates wrote the *Birds of British Burma;* these two specimens form a notable extension of range. They match well with birds from Malay Peninsula whence came the type of *macularia* of which *nuchalis* is a synonym; the Sumatran and Bornean form is *hypogrammica*.]

Piprisoma agile modestum. The Thick-billed Flowerpecker.

Two from Thogale, S. Toungoo in March and April.

(The distribution given in the *F.B.I.* 'hilly country of Burma to Tenasserim, Shan States' is, so far as recorded specimens go, too sweeping. They show that this bird occurs in Pegu and Southern Shan States and throughout Tenasserim, and there are no records or specimens from elsewhere in Burma.)

Serilophus rubropygius. (1334). Hodgson's Broadbill.

Three specimens from Nanhlaing Reserve, Shwebo Forest Division and one specimen from Hkaungton Reserve, Kaukkwe river, Bhamo Forest Division are referred by Dr. Ticehurst to this species, which, according to the *F.B.I.* does not occur in Burma. They were shot in evergreen forest in the foothills, the Shwebo birds in August and the Bhamo bird in January.

(The distribution of the two species *Serilophus rubropygius* and *lunatus,* are not fully known. *Rubropygius* extends from Nepal, Sikkim, Bhutan to Manipur and Eastern Assam. It has been recorded in Arakan in Kyaukpandaung and in the Chin Hills. It occurs in the Myitkyina district and we now have it on the Kaukkwe river and in Shwebo Forest Division, both localities west of the Irrawaddy.

Lunatus has a more southerly distribution from Tavoy north through Tenasserim to the Pegu Yomas, Karen Hills, Karenni, E. Shan States as far north as Mann State and the border of N. Hsenwi and Yunnan. Mr. Garthwaite has now extended the range to Hkaungton R.F., Bhamo Division on the west side of the Irrawaddy. It has been recorded in the Chin Hills otherwise the ranges do not overlap, but as they appeared very near to each other in Bhamo and I have seen no sign of intergradation I regard them as representative species.

The juvenile of *rubropygius* obtained by Mr. Garthwaite is like the adult but the chestnut of the rump extends farther up on to the mantle and the grey of the head and hind neck is faintly washed with this colour also; underparts not so pure a grey; greater wing coverts tipped with white; the silvery white marks of the female on the side of the neck are indicated but they are not so broad and clear.

I can see no evidence of moult of wings and tail at the post-juvenile moult, but the greater wing coverts must be moulted as no winter birds have these with white tips.)

Picus xanthopygaeus (1339). The Little Scaly-bellied Green Woodpecker.

One specimen from Gangaw; one from Kywetnapa, Maymyo; and one from Gada, Shwebo. The distribution in the *F.B.I.* is given as the Chin Hills.

[I have already pointed out that this bird is far more widely distributed in Burma (*J.B.N.H.S.*, xxxvi, 932). Mr. Garthwaite has now provided three further districts.

In *viridanus* the mandibular streak is black with white tips, in *xanthopygaeus* it is dark olive with whitish tips and therefore is not so conspicuous; in *viridanus* the dark markings on the underparts are heavier and there is a pronounced ochraceous wash on the breast. In addition the lateral undertail coverts are *dark with narrow whitish bars* or horse shoe marks, whereas in *xanthophygaeus* these feathers are whitish with narrow dark bars or horse shoes.]

Picus erythropygius nigrigenis (1352). The Red-rumped Green Woodpecker.

One specimen shot in the Baw Reserve, 500 ft. in the Maymyo Forest Division. The jungle here is of the moist type at the foot of the very steep, hot dry slopes, rising up to the Shan plateau. This Woodpecker was one of a pack of three or four of the same species, which was also observed on other occasions in the same locality. They kept to the higher trees, and were not seen near the ground.

The distribution of this bird in the *F.B.I.* is given as 'Karenni and South Toungoo to Tenasserim' so that this record extends the known range considerably.

[The habit of going about in flocks was noted many years ago by Wardlaw-Ramsay.]

Gecinulus grantia grantia (1356). The Pale-headed Woodpecker.

Three specimens of this bird were obtained from the Nanhlaing Reserve, Shwebo Forest Division, two from Pile Reserve, West Katha Forest Division, and one from the Namma Reserve, Bhamo Forest Division. The *F.B.I.* records the occurrence only in the Chin Hills in Burma, but it is evidently common in the foothills of North Eastern Burma.

(Previously recorded outside the Chin Hills by Harington at Bhamo and by Mr. Stanford in the lower hills north of Myitkyina.)

Miglyptes jugularis (1387). The Black and Buff Woodpecker.

One specimen of this rare Woodpecker was obtained in March at Thogale, South Toungoo Forest Division.

Hemicircus canente canente. The Heart-spotted Woodpecker.

Specimens from Kaing R. F., Pyinmana; Gwethe, N. Toungoo.

[Though the *F.B.I.* gives the distribution as through Burma to Malay etc., I can find no evidence that it occurs in Burma north of 20° N. All the records and specimens in the British Museum come from the Arakan Yomas to Pyinmana and South through Toungoo, Pegu, Bassein and Tenasserim (where it must be a very common bird). It appears, however, to be much commoner on the east side of Burma than the west.]

Vivia innominata malayorum. The Malay Speckled Piculet.

Specimens from Maymyo, Pile, Katha; Chaungzon, Shwebo, Namma R. F. Bhamo.

(This Piculet is evidently more widespread than has hitherto been recorded. The distribution in Burma so far as known is N. Tenasserim; Karen Hills, Loi Long and Na Noi in the S. Shan States; Shwebo, Katha, Maymyo and Bhamo Forest Division and Myitkyina District.)

Cyanops asiatica asiatica. The Blue-throat Barbet.

Specimens from Maymyo, Katha, Shwebo, Pyinmana, Toungoo Divisions.

[As explained in the *F.B.I.* some birds from Eastern Burma are intermediate between *asiatica* and *davisoni*.

Birds from Arakan, Chindwin, N. Burma and the western part of the Shan States are *asiatica;* from Pegu, Toungoo and the Karen Hills most are *asiatica* but in some there is a tendency towards *davisoni* in that the band on the crown instead of being black is black mixed with blue; from N. Tenasserim all have the band blue (not black as stated in the *F.B.I.*, iv, p. 118) and are *davisoni*.]

Harpactes oreskios uniformis (1588). Robinson's Yellow-breasted Trogon.

Two specimens from Thogale, South Toungoo Division.

One specimen from Gwethe Reserve, North Toungoo Division.

One specimen from Kaing Reserve, Pyinmana Forest Division.

This bird is recorded in the *F.B.I.* as occurring in Tenasserim only: these records, therefore, extend its northward range greatly. Young birds were seen in the Thogale locality in June, so that it is likely that the bird breeds there.

(Blyth and others have recorded this bird from Arakan, Oates from Pegu, Ramsay from the Karen Hills, Dr. Schanensei from Kengtung State, S. Shan States.)

THE MEDICINAL AND POISONOUS CAMPIONS OF INDIA.

BY

J. F. Caius, S.J., F.L.S.

The Caryophyllaceae are herbs, rarely undershrubs. They mostly inhabit the extra-tropical regions of the northern hemisphere, extending to the Arctic regions and to the tops of the highest Alps. They are rarer in the southern hemisphere, and still more so in the tropics, where they are almost confined to the mountains. They form 80 genera with about 1,300 cosmopolitan species.

The medicinal and poisonous campions and pinks of the world belong to 23 genera:—Agrostemma (Mediterranean region); Alsine (northern hemisphere); Arenaria (northern temperate regions); Bufonia (Mediterranean region); Cerastium (northern temperate regions); Cucubalus (northern temperate regions); Dianthus (Europe, Asia, Africa; mostly Mediterranean); Drymaria (tropical and southern temperate regions); Gypsophila (Europe, Asia; especially eastern Mediterranean); Herniaria (Mediterranean; Europe, South Africa); Holosteum (northern temperate regions); Lychnis (northern temperate regions); Melandrium (northern hemisphere; South Africa, South America); Pollichia (tropical and South Africa); Polycarpaea (cosmopolitan); Polycarpon (cosmopolitan); Sagina (northern temperate regions); Saponaria (northern temperate regions, chiefly Mediterranean); Silene (northern temperate regions, chiefly Mediterranean); Spergula (temperate regions); Spergularia (cosmopolitan); Stellaria (cosmopolitan); Tissa (cosmopolitan).

The medicinal and poisonous campions of India belong to 13 genera:—Arenaria, Cerastium, Cucubalus, Dianthus, Drymaria, Holosteum, Lychnis, Polycarpaea, Polycarpon, Saponaria, Silene, Spergula, Stellaria.

A. Calyx gamosepalous, 4-5 lobed. Petals clawed and stamens inserted on an elongate gynophore (rarely sessible). Styles free. Stipules absent.

I. Capsule dehiscent; styles 2. Seeds pelate; hilum facial; embryo straight.
Calyx bracteate, striate ... ... Dianthus.

II. Capsule bursting by short or long valves. Hilum lateral; embryo annular.

1. Calyx veined. Capsule shortly 4-valved; styles 2 ... ... Saponaria.
2. Calyx 10-∞-nerved. Capsule partially celled, shortly 3-6-valved; styles 3 ... Silene.
3. Calyx 10-nerved. Fruit fleshy; styles 3 ... Cucubalus.
4. Calyx 10-nerved. Capsule shortly 4-5- or 8-10-valved; styles 5. ... ... Lychnis.

B. Sepals free, or connate at the base only. Petals subsessile and stamens inserted on an annular disk, rarely perigynous. Styles free.

- I. Stipules absent. Sepals free. Stamens hypogynous.
    - 1. Petals jagged. Capsule cylindric or conic, 6-valved. Styles 3. Seeds many, compressed ... ... Holosteum.
    - 2. Petals notched or entire. Capsule cylindric or conic, 8-10-valved. Styles 3-5, opposite the sepals. Seeds many ... ... Cerastium.
    - 3. Petals bifid. Capsule globose ovoid or oblong. Styles 3-5. Seeds few or many. Stellaria.
    - 4. Petals entire or lacerate. Capsule globose ovoid or oblong. Styles usually 2-3. Seeds many ... ... Arenaria.
- II. Stipules scarious. Sepals free.
    Petals entire. Styles 3 or 5. Capsules 3- or 5-valved ... ... Spergula.

C. Sepals free. Petals subsessile and stamens inserted on an annular disk. Styles 2-3, combined. Stipules scarious, rarely obsolete.

- I. Sepals not keeled. Petals 2-6-fid. ... ... Drymaria.
- II. Sepals keeled. Petals entire. Style 3-fid ... ... Polycarpon.
- III. Sepals scarious, not keeled. Stigma 3-toothed ... Polycarpaea.

Arenaria.

The genus consists of about 100 species, all natives of cold and temperate regions.

Arenaria serpyllifolia Linn. is found in the subtropical and temperate Himalaya from Nepal to Kashmir, in Rohilkhand and the Punjab at 10,000-11,000 ft., in Western Tibet at 11,000-13,000 ft. It extends to Afghanistan, temperate Europe and Asia.

The herb has long been used in China for bladder diseases. It is considered very valuable for calculus troubles and acute and chronic cystitis.

Chinese: Li Ke Ts'ao—*English*: Lloyd's Sandwort, Sandwort, Thyme-leaved Sandwort—.

Cerastium.

The genus numbers about 100 species, all natives of temperate and cold regions.

C. arvense Linn. is used medicinally in Europe.

Cerastium vulgatum Linn. occurs throughout the temperate and subalpine regions of India and Ceylon, ascending to 15,000 ft. in Sikkim and Western Tibet. It extends to temperate Northern Europe and Asia.

The plant is used in Spain as a mild refrigerant.

English: Chickenweed, Mouse-ear, Mouse-ear Chickweed, Murion—.

CUCUBALUS.

The one species of this genus, **C. bacciferus** Linn., occurs in the temperate Himalaya from Kashmir at 5,000-8,000 ft. to Sikkim at 8,000-12,000 ft.; in the Khasia Hills, at the Boya Pani at 5,000 ft. It is distributed westwards to South Europe, to Central Asia and to West Siberia.

A decoction of the herb is used in Spain to check haemorrhage.

English: Berry-bearing Campion, Bladder Campion—; *French*: Behen baccifère, Coulichon—; *Spanish*: Oreja de vecino, Pamphlina de bayas, Purga cabras—.

DIANTHUS.

The genus includes about 250 species, natives of the northern temperate zone exclusive of Western North America; one of Siberia extending into Arctic America.

D. armeria Linn., *D. barbatus* Linn., *D. carthusianorum* Linn., *D. caryophyllus* Linn., *D. plumarius, D. sylvestris* Wulf. are used medicinally in Europe; *D. superbus* Linn. in China; *D. crenatus* Thunb., *D. scaber* Thunb. in South Africa.

1. Leaves very narrow, rigid, slender, mid-rib very thick, margin much thickened, finely toothed ...	*D. anatolicus.*
2. Leaves channelled above, bent-back, with smooth margins, linear	*D. caryophyllus.*
3. Leaves broad and nearly flat or slightly trough-shaped, 3-5-nerved	*D. chinensis.*

1. **Dianthus anatolicus** Boiss. is found in the Western Himalaya, Western Tibet, Kashmir, and extends to Armenia.

It is used as an antiperiodic in intermittent fevers.

Persian: Kantariyun—.

2. **Dianthus caryophyllus** Linn. is generally supposed to be a native of the Mediterranean. It occurs in Baltistan, the Punjab and Kashmir at 7,000-8,000 ft., extending westwards to Europe.

The flowers are used medicinally in Spain and North America; they are considered cardiotonic, diaphoretic and alexiteric. They are nervine and antispasmodic.

The whole plant is used as a vermifuge in China.

Annam: Cu mach—; *Catalan*: Clavellina—; *English*: Carnation Pink, Clove Pink, Wild Carnation—; *French*: Œillet commun, Œillet des fleuristes, Œilllet giroflée Œillet des jardins, Œillet à ratafia—; *Roumanian*: Garoafa—; *Russian*: Gvasdika—; *Spanish*: Clavelina comun—.

3. **Dianthus chinensis** Linn. is a native of China and Japan cultivated in Indian gardens.

A broth of the fresh new leaves is given in infantile diarrhoea. The old dried leaves are pounded and used in diseases of the eye to clear the eyesight.

The dried flowering plants are used in China as a diuretic, anthelmintic, and abortifacient, In Indo-China the dried flowers and buds are given as a diuretic for indigestion and in difficult labour; they are also prescribed in kidney troubles.

In Malaya the herb is used as a remedy for gonorrhoea.

English : China Pink—; *French* : Œillet de Chine, Œillet de la régence, Œillet rouge—; *Indo-China* : Thach truc, Truc tu hoa—; *Portuguese* : Cravina—.

DRYMARIA.

The genus includes about 40 species; one in tropical Asia and Africa, one in Australia, the rest in America.

D. cordata Willd. and *D. glandulosa* Bartl. are used as cooling medicines in French Guiana.

Drymaria cordata Willd. is found in tropical and sub-tropical India and Ceylon, extending westwards to the Punjab and ascending the Himalaya to 7,000 ft. in Sikkim. It occurs in the Malay Peninsula, Java, Sumatra, Papua, tropical Africa and America.

In French Guiana it is eaten as a salad for its cooling properties.

French Guiana : Mignonnette—.

HOLOSTEUM.

The genus consists of 6 species inhabiting the northern temperate regions.

Holosteum umbellatum Linn. is found in Kashmir, and in cultivated fields in the Quetta valley; it extends to western Asia, North Africa and Europe.

It is reputed to have refreshing and slightly demulcent properties.

English : Umbellate Chickweed—.

LYCHNIS.

The genus is made up of 10 species, natives of Arctic and Temperate northern regions, and of the Andes of South America.

The following are used medicinally in Europe—*L. chalcedonica* Linn., *L. coronaria* Desr., *L. dioica* Linn., L. *flos-cuculi* Linn., *L. githago* Lam.—; in China—*L. grandiflora* Jacq.—; in Indo-China—*L. fulgens* Fisch., L. *Senno* Sieb. and Zucc.—; in South Africa—*L. githago* Lam.—; in North America—*L. alba* Mill.—.

Lychnis coronaria Desr. is abundant in Kashmir: Gadsar, roadsides and dry places; near Shirazia Bagh, on top of hill in rocky and grassy soil; Dachigan Rukh; below Gulmarg, wooded hill-side at 8,000 ft. It extends to West Asia and South Europe.

An extract or a decoction of the root is used in Spain for infraction of the lymph glands of the mesentery, and for diseases of the lungs and the liver.

Catalan : Pessiganassos—; *French* : Coquelourde—; *Spanish* : Candelaria, Claveles lanudos, Coronaria purpurea, Guantes de reina, Rosa de Grecia—.

POLYCARPAEA.

This genus consists of 30 cosmopolitan species.

P. arenaria Gagnep. is used medicinally in Indo-China, *P. corymbosa* Lam. in Malaya and Transvaal, *P. linearifolia* DC. in Nigeria.

Polycarpaea corymbosa Lam. is a cosmopolitan herb. It is found in the Western Peninsula and Ceylon, Central and North-Western India, Sind, ascending the Western Himalaya to 7,000 ft.; it also occurs in Burma and the Malay Peninsula.

The herb is useful in strangury, urinary calculi, boils, inflammatory swellings, and ulcers. Its ash mixed with pepper is applied externally to boils and ulcers (Ayurveda).

The pounded leaves are used as poultice, warm or cold, over boils and inflammatory swellings.

In Pudukotah the herb is administered both externally and internally as a remedy for the bites of venomous reptiles. In Porebunder the pounded leaves are used for bites from animals, and given with molasses in the form of a pill in jaundice.

In Malaya the drug is found in the shops as flowering heads, arising from silvery cymes, with portions of the stem and tomentose leaves, and is used as a demulcent and astringent.

Whether administered internally or applied externally the herb is useless in the treatment of snake-bite (Mhaskar and Caius).

Chinese: Pai T'ou Weng—; *Hausa*: Bakin suda—; *Malaya*: Pak thow yoong—; *Porebunder*: Okharad—; *Rajputana*: Zutaniakhand—; *Sanskrit*: Bhisatta, Okharadi, Tadagamritikodbhava—; *Santal*: Janhenanjur—; *Tamil*: Nilaisedachi—; *Telugu*: Bommasari, Rajuma—.

POLYCARPON.

A small genus of 7 species, distributed throughout all the warm and temperate climates of the world.

Polycarpon indicum Merrill is found in the hotter parts of India in fields and waste places; in Indo-China and tropical Africa.

In Indo-China an infusion of the roasted leaves is given for cough following upon a fever, more particularly measles.

Indo-China: La coc man—.

SAPONARIA.

The genus includes 20 species, chiefly Mediterranean and Western Asiatic.

The following are used medicinally in Europe—*S. ocymoides* Linn., *S. officinalis* Linn., *S. Vaccaria* Linn.—; in China and Indo-China—*S. Vaccaria* Linn.—; on the Pacific Coast: *S. officinalis* Linn.

The root of *S. officinalis* Linn. is official in France. A toxic glucoside, saporubin, has been extracted from it.

Saponaria Vaccaria Linn. is a cosmopolitan weed of cultivation found throughout India.

The Yunani practitioners use the plant for enlargement of the spleen, dysmenorrhoea, and ulcers; the leaves are commonly given for scabies and itch.

The mucilaginous sap of the plant is considered to have febrifuge and tonic properties in long continued fevers of a low type.

In Indo-China the plant is used as a mild depurative. In China it is used in furunculosis and scabies.

The leaves and roots contain from 8 to 15 per cent of saponin.

The seeds contain a sapotoxin, and are somewhat toxic to stock.

Arabic: Gafis, Gleylé—; *Bengal*: Sabuni—; *Brahui*: Karari—; *Chinese*: Wang Pu Liu Hsing—; *Egypt*: Ful-el-'arab—; *English*: Cockle, Cow Basil—; *French*: Blé de vache, Copatte, Saponaire à vaches, Saponaire des vaches—; *German*: Wilder Weid, Kuhkraut—; *Hindi*: Musna—; *Hova*: Savonimbary—; *Indo-China*: Vuơng bat luu hanh—; *Iraq*: Kharaz bint-al-fallah, Ziwan—; *Italian*: Cetino, Mezzettino—; *Malta*: Cow Basil, Cow-herb, Cetino, Mazzettino—; *Mosul*: Ziwan—; *Persian*: Gafis, Guligafis—; *Santali*: Musna—; *Sind*: Musna—; *South Africa*: China Cockle, Cockle, Cow basil, Cow foot, Glond, Soapwort, Spring cockle—; *Spanish*: Teta de vaca—; *Uriya*: Tilothi—.

SILENE.

A genus of 320 species, natives of temperate Europe and Asia, chiefly Mediterranean.

The following are used medicinally in Europe—*S. apetala* Willd., *S. cerastoides* Linn., *S. conoidea* Linn., *S. Cucubalus* Wibel, *S. gallica* Linn., *S. hirsuta* Lag., *S. inaperta* Linn., *S. italica* Pers., *S. nicaeensis* All., *S. nocturna* Linn., *S. nutans* Linn., *S. otites* Sm., *S. rupestris* Linn., *S. saxifraga* Linn., *S. viscosa* Pers.—; in Indo-China—*S. macrosolen* Steud.—; in South Africa—*S. Burchellii* Otth.; *S. capensis* Otth.—; in North America—*S. laciniata* Cav, *S. noctiflora* Linn., *S. stellata* Ait., *S. virginica* Linn.

A. Perennial.
  Petals imbricate in bud. Calyx inflated, 20-nerved, reticulately veined ... ... *S. Cucubalus.*

B. Annuals.
  Petals contorted in aestivation. Calyx not recticulately veined.
    I. Calyx 20-, 30-, or 60-nerved, in fruit conical from a broad base. Petals pink ... ... *S. conoidea.*
    II. Calyx 10-nerved. Flowers in unilateral racemes.
      1. Face of the seeds smooth, rather concave, back deeply grooved with two wavy wings. Petals absent or minute, bright red ... ... *S. apetala.*
      2. Face of the seeds flat with an ear-shaped depression, back not grooved. Petals red or white ... ... *S. gallica.*

1. **Silene Cucubalus** Wibel is found in the temperate Himalaya at 5,000-11,500 ft., from Nepal to the Indus. It is distributed over temperate Asia, Europe and North Africa.

In Spain the plant is considered emollient, and it is used in baths or as a fumigant; the juice is prescribed in ophthalmia.

Baleares: Trons—; *Catalan*: Botets, Colitxos, Culissos, Cuniells, Curibells, Esclafidors—; *English*: Bladder Campion, Inflated Catchfly, White Ben, White

Bottle—; *French*: Behen blanc, Behen commun—; *German*: Klatschnelke, Leimkraut, Schaummohn—; *Italian*: Behen bianco, Bubbolini, Crepa terra—; *Maltese*: Kaskeiza—; *Spanish*: Alcanducea, Cascabelillo de Canarías, Collejas, Conejera, Polemonio pratense—.

2. **Silene conoidea** Linn. occurs in Kashmir and Baluchistan; from Kumaon to the Indus and from Oudh to the Punjab; in West Tibet at Ladakh. It extends westwards to the Atlantic Ocean.

The plant is used therapeutically in Spain as a substitute for *S. Cucubalus*.

Harboi Hills: Dardiri—; *Kalat*: Gardi—; *Kharan*: Guto—; *Spanish*: Claveletas de barranco—.

3. **Silene apetala** Willd. is found in Peshawar; it extends through Afghanistan and Persia to South Europe and North Africa.

In Spain the juice is used in eye troubles; the plant is used in baths or as a fomentation for its emollient properties.

4. **Silena gallica** Linn. is found in Garhwal and in the Carnatic; it is common everywhere in the Mediterranean region.

The plant is used in Spain as a substitute for *S. Cucubalus*.

Spanish: Carmentilla—.

SPERGULA.

A very small genus of 3 European and Asiatic species.

Spergula arvensis Linn. is found in cultivated fields in various cool parts of India and throughout the northern hemisphere.

It is used as a diuretic in Colombia.

Bogotá: Abrojito—; *Dutch*: Spurrie—; *English*: Beggar-weed, Bottle Brush, Cowquake, Dodder, Dother, Farmer's Ruin, Franke, Granyagh, Lousy Grass, Make-beggar, Mountain Flax, Pick Pocket, Pick Purse, Poverty Weed, Sandweed, Spurrey, Spurry, Toad Flax, Yarr, Yarrel, Yawr, Yur—; *French*: Espargoule, Espargoute, Espargoutte, Spargoule, Spargoute, Spergoute, Spergule, Sperjule—; *German*: Spergel—; *Roumanian*: Granat—; *Russian*: Taritsa—; *Spanish*: Espergula—.

STELLARIA.

A genus of about 100 species, dispersed over the whole world, but most abundant in cold and temperate regions.

A. Annual.
  Sepals free to the base. Petals shorter than the calyx or absent. Stamens 3-10, hypogynous. Styles 3. Capsule with 4-6 entire valves ... ... *S. media*.

B. Perennials.
  I. Sepals free to the base. Petals with diverging lobes. Stamens hypogynous. Styles 5. Capsule with 5 bifid valves ... ... *S. aquatica*.

  II. Sepals more or less connate at the base into an obconic tube. Petals minute or absent. Stamens 10, perigynous. Styles 3. Capsule with 6 entire valves ... ... *S. uliginosa*.

1. **Stellaria media** Linn. is found in cultivated and waste places, roadsides and edges of streams throughout the Punjab and temperate regions of India, ascending in the Himalya to 12,000 ft,

and in Western Tibet to 14,500 ft.; in the Mediterranean basin, throughout Europe and northern Asia, and carried out as a weed to all the temperate and colder regions of the globe.

The plant is employed in plaster for broken bones and swellings, as it is supposed to be binding and cooling.

The herb is used in Spain as a vulnerary, astringent and resolvent. On the Pacific Coast it is reputed refrigerant, demulcent and alterative.

Catalan: Burrissol, Murrons, Murrons blanchs, Murrons de canari, Picagallina, Picapoll—; *Dutch*: Muur—; *Egypt*: Gezâze—; *English*: Chickweed, Common chickweed—; *French*: Alsiné, Alsiné des oiseaux, Mouron blanc, Mouron des oiseaux, Mouron d'hiver, Morsgeline, Morsgeline—; *German*: Augentrostgras—; *Italian*: Budellina, Centonchio, Centoncolo, Morgellina, Paperina—; *Malta*: Common Chickweed, Budellina, Centocchio, Paperina, Harira bajda—; *Pacific Coast*: Alsine, Chickenweed, Common Chickweed, Satin-flower, Tongue-grass, White-bird, Winter-weed—; *Roumanian*: Limba vrabiei—; *Russian*: Makritsa—; *Spanish*: Pamplina, Pamplina de canarios, Pajarera, Yerba gallina, Yerba pajarera—.

2. **Stellaria aquatica** Scop. occurs in the temperate Himalaya from Nepal to Marri, at 4,000-8,000 ft. It extends to Northern and Western Asia, Europe, and North Africa.

In Indo-China a decoction of the leaves is given as a galactagogue to nursing mothers suffering from want of milk.

In China the plant is used for the treatment of fistulae.

Chinese: Fan Lu—; *English*: Chickweed, Great Chickweed, Water Chickweed—; *French*: Stellaire aquatique—; *Indo-China*: Phon lau—; *Malta*; Water Starwort, Budellina d' acqua—.

3. **Stellaria uliginosa** Murr. is found in wet places of the temperate and alpine regions at 4,000-10,000 ft.; in the temperate and alpine Himalaya from Kashmir to Sikkim, here up to 16,000 ft.; in the Khasia Hills at 5,000-6,000 ft. It is generally distributed over the temperate regions of the northern hemisphere.

A decoction of the leaves is used as a galactagogue in Indo-China.

English: Bog Stitchwort—; *Indo-China*: Tuoc thiet thao—.

THE ORNITHOLOGY OF TRAVANCORE AND COCHIN.

BY

SÁLIM ALI.

With Notes by HUGH WHISTLER.

PART VIII.

(*Concluded from page 342 of this volume*).

ORDER: PTEROCLETES.

FAMILY: PTEROCLIDÆ.

[**Pterocles exustus ellioti** Bogdanow. The Common Indian Sandgrouse.

Not met with by the Surveys, neither recorded from Travancore by Bourdillon or Ferguson.

In the *Fauna* (v, 272) as well as *Nidification* (v, 185) it is stated that the Common Sandgrouse is found 'in the open parts of Travancore'. Mr. Stuart Baker further writes (*Game Birds of India*, ii, 297) that he has received its eggs from Travancore. The dry low country about Cape Comorin and Arāmboli, where the Ring Dove and the Little Brown Dove were found, certainly appears suited to the requirements of this species, but a confirmation of its occurrence and breeding in Travancore is nevertheless desirable.]

ORDER: GALLINÆ.

SUB-ORDER: ALECTOROPODES.

FAMILY: PHASIANIDÆ.

SUB-FAMILY: PAVONINÆ.

Pavo cristatus Linnaeus. The Common Peafowl.

Not met with by the Surveys.

According to Ferguson (*J.B.N.H.S.*, xvi, 3) the Peafowl was at one time common at the foot of the hills in South Travancore, though no longer so at the time of his writing (1904). He also came across it in the hills about Peermade.

I was informed by the Forest Range Officer of Wadakkāncheri that 4 or 5 years previously he had shot peafowl at a place called Mylātampāra (meaning 'Peacock-dancing rock') in Cochin, near Mulloorkara Railway Station, and that there were some still to be found in this locality. The species, however, seems at present to be very rare in a wild state in Travancore and Cochin.

In the Palni Hills, Fairbank (*S.F.*, v, 409) observed it at the northern base. He wrote this as long ago as 1868 or thereabouts, and no more recent information is available.

Breeding: There is nothing recorded concerning our area.

SUB-FAMILY: PHASIANINÆ.

Gallus sonneratii Temminck. The Grey Jungle Fowl.

Specimen collected: 491 ♂ 26-3-33 Tenmalai 500 ft.

Elsewhere noted and/or shot at: Maraiyūr (3,500 ft.); Sānthanpāra (3,500 ft.); Thattakād (200 ft.); Peermade (3,200 ft.); Rājampāra (1,350 ft.); Tenmalai (500 ft.); Kūriārkutti (1,600 ft.); Wadakkāncheri (400 ft.); Pādagiri (3,000 ft.).

Colours of bare parts : *Adult* ♂. Iris dusky chrome yellow; bill yellowish flesh colour, dark horny brown on culmen ; comb and wattles bright crimson ; legs and feet yellowish and pale magenta ; claws horny brown ; spurs darker brown.

[Measurements :

	Bill.	Wing.	Tail.	Tarsus.
4 ♂♂	33·5-35	223-243	314-375	69-73·5 mm.
4 ♀♀	32-33	187-201	99-115	60-63 mm.

I have seen 8 additional Travancore specimens, but none have any proper data.—H. W.]

The Grey Jungle-fowl is very common in the forested tracts of Travancore and Cochin, both hill and plain. It was noted as most abundant in the foothills country, but was also met with up to an elevation of about 4,500 ft. About Thattakād, with its secondary scrub jungle and mixed deciduous and evergreen forest, with abandoned overgrown rubber plantations here and there and scattered toungya clearings and cultivation, these birds seemed to have struck optimum conditions and were, indeed, more numerous than I have ever seen them elsewhere in India. The crowing of the cocks was to be heard on every side, chiefly in the mornings and evenings. Here the cocks usually had one bout of interim all-round crowing every morning between 3 and 3.30 a.m. when it was still pitch dark. Cocks from far and near vied in answering one another. After this there was silence again for two hours or so until it was light enough for the birds to bestir themselves. The crowing is usually, but not invariably, preceded by a loud flapping of the wings against their sides.

In the vicinity of the camp shed at Thattakād there was ploughing in progress in a fallow field, and parties of jungle-fowl were usually to be seen following the plough or feeding unconcernedly within a few yards of the small boy and his bullocks.

In the Nelliampathy Hills, jungle-fowl were mostly met with at the edge of tea and coffee plantations and in the secondary jungle surrounding them. Kinloch (*J.B.N.H.S.*, xxvii, 943) indeed found them very common everywhere in these hills, especially when the *Strobilanthes* and bamboos were in seed.

In the Palni Hills, Fairbank (*S.F.*, v. 409) observed this jungle-fowl at 5,000 ft. elevation, but owing to being much hunted it was already, in his time, rare on the hills. Terry (*S.F.*, x, 479) observed a few in the large sholas, but found it commoner in the thick scrub jungle on the lower slopes and in valleys. This was the case 50 to 60 years ago and as its persecution had already then commenced, it would be interesting to learn of its present status.

It does not occur in Ceylon.

Breeding: The testes of the specimen (26 March) measured 29 × 11 mm. and the bird was undoubtedly breeding. On 3 February (Thattakād) a brood of 4-5 chicks, apparently about 6 weeks old, were observed with their mother.

According to Ferguson (*J.B.N.H.S.*, xvi, 3) the breeding season in South Travancore is February and March. Stewart and Bourdillon (*Nidification*, iv, 200) took eggs in Travancore between March and July ; in the Nelliampathy Hills Kinloch found eggs from February to October.

From the evidence it appears that there is no hard and fast breeding season in Travancore and Cochin, and it perhaps varies with local conditions. The greater part of the breeding, however, certainly takes place between February and July. The normal clutch is said to consist of 3-5 eggs. Ferguson once found a nest containing seven.

SUB-FAMILY : PERDICINÆ.

Galloperdix spadicea stewarti Stuart Baker. The Travancore Red Spur-fowl.

Specimens collected : 376 ♂ 28-2-33 Kūmili 3,000 ft. ; 479 ♂, 480 ♀ juv., 21-3-33 Rājampāra 1,350 ft. ; 658 ♂, 25-4-33 near Mūthūkūzhi, 3,500 ft.—Ashāmbū Hills.

Elsewhere noted and/or shot at : Marāiyūr (3,500 ft.) ; Thattakād (200 ft.) ; Periyār Lake Environs (ca. 3,000 ft.) ; Tenmalai (500 ft.) ; Arāmboli (250 ft.) ; Kūriārkūtti (1,600 ft.) ; Wadakkāncheri (400 ft.) ; Pādagiri (3,000 ft.), Colours of bare parts: *Adult*: Iris yellowish-brown or orange-brown; bill basal half bright pink, terminal half pale horny brown; orbital skin bright rose pink; legs and feet salmon pink or orange-coral; mouth pink; claws and spurs pale horny brown. *Juvenile* (No. 480) Iris olive brown; rest as in adult, but much paler everywhere.

[Additional specimens examined:

Brit. Mus. Coll.: ♂ 21-2-14, ♂ imm. 23-2-14, ♂♂ -7-19, ♀ -8-19 Aneichardi (Stewart). Also some Fry specimens without proper data.)

Measurements:

	Bill.	Wing.	Tail.	Tarsus.
6 adult ♂♂	22-25.5	153-164	116-136	49-55 mm.
1 ♀	20	148	118	... mm.

The male evidently assumes adult plumage at the post-juvenal moult. H. W.]

The Spur-fowl is a cmomon resident species in Travancore and Cochin, principally in the foothills country where clothed with deciduous and mixed scrub or secondary jungle, but also at higher elevations—up to 3,500 feet at least—in suitable facies. It has a preference for dry scrub-covered hillsides with rocky outcrops and the ravines at their base. Pairs and family parties of 3 to 6 birds were usually met with. Often when suddenly come upon it flies up into the branches of overhanging or nearby trees.

Kinloch (*J.B.N.H.S.*, xxvii, 943) describes the Spur-fowl as very common everywhere in the Nelliampathy Hills. In the Palnis, Fairbank (*S.F.*, v, 409) saw only one, but Terry (*S.F.*, x, 479) found it common at Pittur. No specimens from Cochin or the Palni Hills are available for examination however, hence the subspecies is only probable.

It is not found in Ceylon.

Breeding: The adult specimens collected by the Survey showed no gonadal development, but No. 480 (21 March) was a young bird—one of a brood of 2 or 3 accompanied by parents—undergoing complete post-juvenal moult. On 17 April (Arāmboli) an adult accompanied by at least 3 downy chicks was observed.

Nidification (iv, 228) states that Stewart and Bourdillon obtained many clutches of eggs of this Spur-fowl in Travancore at between 1 and 3 thousand feet elevation. The season is said to be irregular, from January to the end of March or early April, and a few birds are said to breed again in September and October.

Galloperdix lunulata Valenciennes. The Painted Spur-fowl.

No specimen procured, and not previously recorded from Travancore or Cochin.

At Arāmboli (21 April) I observed an adult accompanied by 4 (or 5?) half-grown chicks in sparse scrub and thorn country on the side of a boulder strewn hillock. As I had an unobstructed view of this family party through field glasses, I feel satisfied about the correctness of my identification.

Excalfactoria chinensis chinensis (Linn.). The Blue-breasted Quail.

Not met with by the Surveys.

According to Ferguson (*J.B.N.H.S.*, xvi, 4) this little quail occurs on the grasslands at Peermade. He believes that it breeds in Travancore although the evidence cited seems far from satisfactory. Stuart Baker (*Fauna*, v, 370) even calls it 'a common breeding bird in Travancore and the Malabar coast to Bombay . . .' On what authority this statement is based is not known, but I cannot think that it is wholly accurate.

Coturnix coturnix (Linnaeus). The Common or Grey Quail.

No specimen procured. A single bird, presumably this species, was flushed on a grassy hillside at Peermade, ca. 3,500 ft. elevation (22 February).

Ferguson's statement (*J.B.N.H.S.*, xvi, 4) that according to his information it is not uncommon on the grasslands at Peermade where it is known as the 'drummer', refers in all probability to the Bustard Quail. The Common Quail does not drum or 'purr' as far as I am aware to deserve this epithet.

No Travancore or Cochin specimens are available for racial attribution.

Coturnix coromandelicus (Gmelin). The Black-breasted or Rain Quail.

Not met with by the Surveys, neither recorded by Ferguson and others from Travancore or Cochin. Mr. Whistler points out, however, (*J.B.N.H.S.*, xxxviii, 685) that there are 2 ♂♂ in the British Museum collected in Travancore, apparently near Trivandrum, by Surgeon-General Fry.

Perdicula asiatica subsp.? The Jungle Bush Quail.

Specimens not procured.

Noted at: Chālakūdi, Wadakkāncheri (400 ft.) in deciduous scrub-and-bush country.

Ferguson (*J.B.N.H.S.*, xvi, 4) says that the Bush-Quail is found about Cape Comorin but nowhere else in Travancore within his knowledge. The species must be rare since the Survey did not once come across it either in the locality named by him or about Arāmboli—another likely spot. The latter, moreover, adjoins the dry Madras district of Tinnevelly whence according to Ferguson numbers are brought alive to Trivandrum for sale.

The race *P. a. ceylonensis* Whistler occurs in Ceylon.

Breeding: 'In Travancore Stewart found them breeding from January to March, most eggs being laid in February' (*Nidification*, iv, 240). A full clutch is said to consist of from 4 to 8 eggs, most often 5 or 6.

Cryptoplectron erythrorhynchum (Sykes). The Painted Bush-Quail.

Specimens collected: 184 ♀, 185 ♂ 29-1-33 Sānthanpāra 3,500 ft.; 333 ♂ 22-2-33 Peermade 3,200 ft.

Elsewhere noted at: Kūmili and Periyār Lake Environs (ca 3,000 ft.).

Colours of bare parts: Iris yellowish-brown; bill coral pink, brownish at tip of both mandibles; legs and feet coral pink; claws dusky.

[Additional specimens seen:

Brit. Mus. Coll. ♀ -4-97 Devicolum, Travancore (Ferguson). Also some other Travancore specimens without data.

Sparrow Coll.: ♂ 27-3-14 Cardamom Hills.

Measurements:

	Bill.	Wing.	Tail.	Tarsus.
3 ♂♂	14.5-16	81-87	40-44	23-25 mm.
3 ♀♀	14.5-16.5	81.5-92.5	43.5-45	24.5 mm.—H. W.]

The Painted Bush-Quail is a common species on the hills of North Travancore. The Survey did not come across it below an elevation of about 2,500 ft., or south of about Kūmili. How much further south it extends is not known. Ferguson (*J.B.N.H.S.*, xvi, 4) records it only from the Cardamom Hills and the High Range. H. J. Elwes (*Ibis* 1870, pp. 526-28) records it as extremely abundant in the long grass on the Cardamom Hills. Kinloch (*J.B.N.H.S.*, xxix, 565) found it very common on the Lily Downs of the Cochin Nelliampathies at about 4,700 ft.

Coveys, usually of 6-10 birds, were commonly flushed among tall coarse grass on open hillsides, especially by the edge of sholas. In the mornings and evenings the birds came out into opener patches to feed, and were then frequently to be seen dusting themselves on paths etc. in suitable facies.

In the Palni Hills this Bush-Quail is fairly common in places, according to Terry (*S.F.*, x, 479); and Fairbank (*S.F.*, v, 409) obtained it in the Kodaikanal, ca 7,000 ft.

It does not occur in Ceylon.

Breeding: The gonads of the specimens were inactive. On 7 March a pair of adults accompanied by 4 or 5 chicks—about the size of a Munia, and able to fly—were flushed in secondary scrub and bamboo brushwood on the edge of Periyār Lake.

Nidification (iv, 243) mentions that in Travancore Bourdillon obtained eggs in January, February, July to September, and again in December, which suggests that the season is not well-defined. The normal clutch is said to be of 4-6 eggs.

Francolinus pondicerianus pondicerianus (Gmelin). The Southern Grey Partridge.

Specimen not obtained.

The Surveys only came across the Grey Partridge—in small numbers—in the dry, open scrub and cultivated country around Cape Comorin; nowhere else in Travancore or Cochin. Ferguson (*J.B.N.H.S.*, xvi, 4) also records it from this same area and says that it is not found elsewhere in Travancore.

In the Palni Hills, Fairbank (*S.F.*, v, 409) observed it at Periakulam. It occurs in the dry country in Ceylon.

Breeding: No specific information concerning its breeding in our area is available. According to the *Fauna* (v, 420) it apparently has two seasons in South India, one from February to May and the second August to October.

ORDER: HEMIPODII.

FAMILY: TURNICIDÆ.

Turnix suscitator [**taigoor** (Sykes)]. The Common Bustard Quail.

Specimen not obtained.

The Travancore Survey has only 2 records of the Bustard Quail: (1) Kūmili, 3,000 ft., 1-3-33—A pair in tall grass in deciduous country—Periyār Lake Environs, and (2) Arāmboli, 17-4-33—heard drumming. It was not met with in Cochin.

Ferguson (*J.B.N.H.S.*, xvi, 5) describes it as 'Not uncommon in scrub jungle in the low country' (of Travancore). This is a statement that I am unable to confirm. In my experience the species was definitely rare.

Mr. Whistler points out (*J.B.N.H.S.*, xxxviii, 689) that in the British Museum Collection there is a female collected by Nair on 15 February 1899 at Padmanabhapuram which cannot be distinguished from the Cinghalese race *T. s. leggei.* He mentions at the same time that there is great individual variation in these Bustard Quails and that only a collection of fresh material will enable the difficulty as regards races to be settled. Regarding the locality, Padmanabhapuram, Mr. N. G. Pillai informs me that there is a place of that name in South Travancore noted chiefly for an old palace with a remarkable series of mural paintings. The identity of the collector, Nair, however cannot be unearthed. He was apparently not a collector of the Trivandrum Museum.

[**Turnix sylvatica dussumieri** (Temm. and Lang). The Little Button Quail.

Not met with by the Surveys, nor apparently by Ferguson or Bourdillon.

Nidification (iv, 286) records, however, that Stewart twice found it breeding in Travancore. As no specimens were apparently taken, further evidence is desirable before the species can be admitted to the Travancore list.]

Turnix tanki tanki Blyth. The Indian Button Quail.

Not met with by the Surveys.

Ferguson himself never came across this quail in Travancore, neither were there in his time (nor are there now) any skins in the Trivandrum Museum collection. He included the species in his Travancore list (*J.B.N.H.S.*, xvi, 5) in the belief that it had been recorded hence previously. He was evidently referring to the skin sent by Bourdillon from South Travancore to Hume. (Hume and Marshal, *Game Birds of India*, ii, 187).

In the Palni Hills, Terry (*S.F.*, x, 479) claims to have shot one of these quails, but the skin was not preserved and there has been no confirmation of its occurrence since. It has not been recorded from Ceylon.

Breeding: According to *Nidification* (iv, 287) Bourdillon found the Indian Button Quail breeding in South Travancore where he took eggs on 3 January.

ORDER: GRALLÆ.

SUB-ORDER: FULICARIÆ.

FAMILY: RALLIDÆ.

Hypotaenidia striata gularis (Horsfield). The Indian Blue-breasted Banded Rail.

Not met with by the Surveys.

Ferguson writes (*J.B.N.H.S.*, xvi, 5); 'These birds may be found scattered about in marshy thickets near the coast. From the contents of their stomach, beetles appear to be their chief food'.

I have seen no Travancore specimens and there appear to be none in the British Museum except a pair in the Hume Collection from the 'West coast of Madras' which Mr. Whistler thinks may perhaps mean Travancore.

In the Palni Hills, Terry (*S.F.*, x, 480) shot a female on 4 April. This specimen is now in Dr. C. B. Ticehurst's collection (*J.B.N.H.S.*, xxxviii, 690).

It occurs in Ceylon.

Breeding: While presumably a resident species, nothing has been recorded about its breeding in Travancore or Cochin.

Porzana pusilla pusilla (Pallas). The Eastern Baillon's Crake.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xvi, 5) records that a single specimen was brought to him alive in December. According to him it is apparently a rare bird in Travancore.

Mr. Whistler has examined a Travancore specimen in the British Museum Collection labelled: o 18-11-1878 Charki, Trivandrum (Bourdillon).

It has not been recorded from the Palni Hills, but it occurs in Ceylon evidently as a winter visitor.

Breeding: While the majority of birds in the peninsula are winter visitors only, some apparently remain behind to breed in the plains. There are no undoubted records of its breeding in Travancore or Cochin, but Ferguson mentions that the bird brought to him had evidently bred there as it was reported to have had a young one with it. In the absence of confirmation this record seems doubtful.

Rallus eurizonoides amuroptera (Jerdon). The Banded Crake.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xvi, 5) procured a single specimen of this crake in 1875 in some paddy fields enar the foot of the hills in South Travancore at about 400 ft. elevation. There is, according to Mr. Whistler, one Travancore specimen labelled 'Mynall' with no other data in the British Museum (Hume Collection), and a second, also without data, collected by Fry. It occurs in Ceylon.

Breeding: No information available for Travancore or Cochin.

Amaurornis fuscus subsp? The Ruddy Crake.

Specimen collected: 421 ♂ 7-3-33 Kūmili 3,000ft.

Elsewhere not noted.

Colours of bare parts: Iris reddish-orange; bill horny slate; legs and feet dusky coral; claws horny brown.

[The specimen, ♂, measures: Bill 22.5; Wing 101; Tail 50; Tarsus 35 mm.

Additional specimen seen: *Brit. Mus. Coll.*: o? no data (Travancore) (Bourdillon).

As explained in the Eastern Ghats Survey (*J.B.N.H.S.*, xxxviii, 692) I do not recognise the race *A. f. zeylonicus*. South Indian and Cinghalese birds are quite inseparable from the typical race of the Philippines. Southern birds measure: Wing 90.5-98.5 mm. North Indian birds (*A. f. bakeri*) have wings 100.5-109 mm. As the series from the South is inadequate and not properly sexed, these measurements may not be fully representative so I hesitate to draw the obvious deduction that the Survey specimen is a migrant of *A. f. bakeri*. Southern birds may possibly on occasion reach 101 mm. —H. W.]

The specimen was one of a pair in brushwood by a swamp on the margin of Periyār Lake. No others were seen.

According to Ferguson (*J.B.N.H.S.*, xvi, 5) the Ruddy Crake is fairly common in Travancore. I cannot say, however, whether this statement is based merely on the fact that there were 6 specimens (3 from Kottayam) in the Trivandrum Museum during his time, or on more substantial grounds.

It occurs in Ceylon, but as regards the Ceylonese race see Mr. Whistler's remarks, *supra*.

Breeding: *Nidification* (iv, 300) records that Stewart only once took a nest of this Crake in Travancore, but gives no other particulars.

Amaurornis phoenicurus phoenicurus (Pennant). The White-breasted Waterhen.

Specimen collected: 420 ♀ 7-3-33 Kūmili (Periyār Lake) 3,000 ft.

Elsewhere noted at: Thattakād (200 ft.); Kōttayam Backwaters (Vembanād Lake, Munro Island, etc.). Arāmboli (250 ft.); Karūpadanna (ca. S.L.).

Colours of bare parts: Iris orange-brown; bill pale sage green, brownish on culmen; legs and feet dusky chrome yellow; claws horny-brown.

[The specimen measures: Bill 34.5, Wing 158, Tail 61.5, Tarsus 59 mm. No other Travancore specimens seen.—H. W.]

The White-breasted Water-hen is fairly common in Travancore and Cochin wherever there are paddy fields and swampy land whose marginal vegetation it habitually frequents. Ferguson (*J.B.N.H.S.*, xvi, 6) apparently believed it to be restricted to the low country.

It is usually seen singly or in pairs, skulking about amongst brushwood and *Pandanus* scrub on the edges of streams, tanks, paddy-fields and water channels. At the middle of April it was heard calling, chiefly at night and in the early mornings. The well-known call—indicative of the breeding season—is a monotonous, metallic *coot-coot-coot* (not unlike that of the Coppersmith) repeated in quick succession for quite 10 or 15 minutes at a stretch. A range of weird and raucous croaks and chuckles usually precedes the 'cooting'. The call is uttered from the centre or near the top of a bush into which the bird has clambered.

The same race occurs also in Ceylon.

Breeding: The ovary of the specimen (7 March) was undeveloped. No specific records are available, but Ferguson says that in Travancore it breeds in April.

Gallinula chloropus indicus Blyth. The Indian Moorhen.

Not met with by the Surveys.

Ferguson writes (*J.B.N.H.S.*, xvi, 6): 'The Moorhen is by no means common in Travancore; the Museum possesses only a single specimen'. No further information is available concerning the species in Travancore or Cochin.

Gallicrex cinerea (Gmelin). The Kora or Water-Cock.

Specimen collected: 1047 ♂ 30-12-35 Karūpadanna ca. S.L.

Elsewhere not noted.

Colours of bare parts: Iris hazel brown; upper mandible brownish olive-green, lower mandible pale olive yellow; forehead dusky olive; legs and feet olive green; claws horny brown.

[The specimen measures: Bill 43, Wing 215, Tail 83 mm.

Additional specimens seen: *Brit. Mus. Coll.*: 2 ♀♀ no data Anjango —H. W.]

The specimen—in non-breeding plumage—was solitary amongst bushes and brushwood bordering a kutcha pond at the edge of paddy cultivation. Ferguson (*J.B.N.H.S.*, xvi, 6) describes the Water-Cock as not uncommon (in Travancore) in and about rice cultivation in the low country.

It occurs in Ceylon.

Breeding: Nothing recorded for Travancore or Cochin.

Porphyrio poliocephalus poliocephalus (Latham). The Indian Purple Moorhen.

The Surveys did not come across this species, but it was accurately described to me and reported to be common about inundated paddy fields and around the backwaters at Kōttayam and Karūpadanna.

According to Ferguson (*J.B.N.H.S.*, xvi, 6) it is common on all the larger lakes (in Travancore) wherever there are reeds and rushes.

It is found in Ceylon.

Breeding: Ferguson says that in Travancore it breeds in July and August.

SUB-ORDER: JACANÆ.

FAMILY: JACANIDÆ.

Metopidius indicus (Latham). The Bronze-winged Jacana.

Specimen not obtained.

Noted at: Cape Comorin (ca. S.L.); Nemmāra (300 ft.).

[Travancore specimens seen :
Brit. Mus. Coll. : ♂ 5-2-1879 Vellárney Lake (Bourdillon); one without data collected by Surgeon-General Fry.—H. W.]

This species appears to be rather uncommon in Travancore and Cochin. It was met with occasionally, either singly or in twos or threes, on lotus covered tanks.

Ferguson (*J.B.N.H.S.*, xvi, 7) however, says that it may be met with throughout Travancore in suitable localities where there are lakes or tanks well covered with weeds and water lilies.

Breeding: Bourdillon obtained eggs in Travancore in August (*Nidification*, iv, 321).

Hydrophasianus chirurgus (Scopoli). The Pheasant-tailed Jacana.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xvi, 7) found flocks common in Travancore, especially about Nagercoil, keeping to the floating weeds well away from the banks.

Breeding: No information is available concerning its nidification in our area.

SUB-ORDER: ROSTRATULÆ.

FAMILY: ROSTRATULIDÆ.

Rostratula benghalensis benghalensis (Linn.). The Painted Snipe.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xvi, 11) describes the Painted Snipe as fairly common throughout the low country wherever there are rushy marshes, and he also found it in paddy-fields. Stuart Baker (*Game Birds*, ii, 124) says that in Travancore it seems to be found up to 3,000 ft. and that he has had eggs sent him for identification taken at that elevation.

It occurs in Ceylon.

Breeding: In Travancore Ferguson had eggs brought to him in December and young birds in February. Nothing further seems to be recorded.

SUB-ORDER: OTIDES.

FAMILY: OTIDIDÆ.

Sypheotides indica (Miller). The Lesser Florican or Likh.

Ferguson (*J.B.N.H.S.*, xvi, 6) writes that in 1876 a specimen was shot in some rushes in Trivandrum. I believe this is the only record for Travancore and its occurrence here must certainly be considered very exceptional.

ORDER: CHARADRIIFORMES.

SUB-ORDER: OTI-LIMICOLÆ.

FAMILY: ŒDICNEMIDÆ.

Burhinus oedicnemus indicus (Salvadori). The Indian Stone-Plover.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xvi, 6) came across and shot these birds more than once when snipe-shooting at Veli—4 miles from Trivandrum. The soil in this locality was sandy and clothed with shrubs and cocoanut palms. The plovers were sometimes in small parties of 3 or 4, otherwise solitary.

Breeding: It is said (*ibid.*) to breed in Travancore in August.

SUB-ORDER: LARO-LIMICOLÆ.

FAMILY: GLAREOLIDÆ.

SUB-FAMILY: CURSORIINÆ.

Cursorius coromandelicus coromandelicus (Gmelin). The Indian Courser.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xvi, 6) writes: 'My collector shot 2 of these 8 miles south of Quilon on some sandy plains in June 1902. Four more were subsequently obtained 12 miles south of Quilon. Among them was a young bird in quite immature plumage, so that I believe they must breed here. I have not found this bird in any other locality, and do not think it is likely to be seen further north.'

According to Stewart (apud *Nidification*, iv, 345) this Courser is common in the deforested areas of Travancore. We have no information concerning its occurrence or status in Cochin.

Breeding: Stewart (*ibid*) took many eggs in Travancore in bare ploughed fields, and gives the season here as May to July.

SUB-FAMILY: GLAREOLINÆ.

Glareola lactea Temminck. The Small Indian Pratincole or Sand-Plover.

Not met with by the Surveys.

Ferguson's collectors obtained specimens from Velyani, near Alwaye. They were met with in flocks of a dozen or more individuals frequenting open flats on either side of the Alwaye river up to Malayattur.

No other information from Travancore or Cochin is available.

FAMILY: STERCORARIIDÆ.

Catharacta skua lönnbergi Mathews. The Great Skua.

Specimen: 861 o? 20-9-33 Poojappura ca. 150 ft.—Trivandrum Environs.

The specimen was captured by fishermen in an exhausted condition on a large sheet of water—about 10 acres in extent—near the Karamanai river. It was solitary.

[Measurements: Bill 69, Wing 430, Tail 156, Tarsus 80 mm.

This specimen appears to provide the first record of this species for India. It was carefully identified for me at the British Museum by Mr. Hamilton when he was working at this puzzling group.

It will however be recalled that there are 5 records of Great Skuas for Ceylon, and there can be little doubt that if sufficient observers were present this species—speaking in the wide sense and without regard to the varying opinions as to the number of species and subspecies into which it may be divided—would be found to be a more or less regular straggler to the seas round Ceylon and South India. The known records appear to be as follows:

(1) A specimen brought alive to Legge in October 1875 with its wing clipped, said to have been caught a few weeks previously on the brackish canal which threads the lagoons between Negombo and Chilaw. Named as *Stercorarius antarcticus* (Legge, *Birds of Ceylon*, p. 1050).

(2) A specimen obtained by the lighthouse keeper at Foul Point, Trincomalee, caught in an exhausted state on the beach in a storm during the north-east monsoon between 1877 and 1885. This is in the Colombo Museum and was identified some years ago at the British Museum as *S. antarcticus*.

(3) A specimen shot, apparently between Chilaw and Negombo, in October 1885 and now in the Colombo Museum. Identified as *S. antarcticus antarcticus* (loc. cit.).

(4) A specimen obtained at Kalutara, 25 miles south of Colombo, on 22 September 1907 and now in the Colombo Museum. Identified as *S. a. antarcticus* (loc. cit.).

(5) A specimen seen at sea by Nicholl off the south-east of Ceylon in 5°23′ N×84°45′ E (Ticehurst, *J.B.N.H.S.*, xxxiv, 482).

It is not unlikely that an examination of the above specimens, in the light of recent research on this group, would result in some modification of the identifications.—H. W.]

FAMILY: LARIDÆ.

Larus ichthyaëtus Pallas. The Great Black-backed Gull.

Specimens collected: 300 ♀ ad. 17-2-33, 307 ♂ ad., 308 ♂ imm. 18-2-33 Vembanād Backwaters, Kōttayam.

Elsewhere not noted.

Colours of bare parts: *Adult* Iris hazel brown; fine circumorbital ring (eyelids) coral red; basal 2/3 of bill bright yellow, followed by a bright reddish-orange patch and then by a subterminal band of blackish-brown. Tips paler yellow; gape and mouth bright orange; legs and feet bright yellow; claws horny black. *Immature* Fine circumorbital ring (eyelids) blackish-brown; basal 2/3 of bill greenish-yellow or sulphur yellow, tip reddish orange; legs and feet greenish-yellow or sulphur yellow; rest as in adult.

[Measurements :

	Bill.	Wing.	Tail.	Tarsus.
1 ♂ ad.	76	481	197	71.5 mm.
1 ♀ ad.	70.5	440	174	69 mm.
1 ♂ imm.	77.5	482	189	75 mm.—H. W.]

The Great Black-backed Gull was noted in fair numbers and as the commonest species of gull on the Vembanād Backwaters during the period the Survey worked this area—in February. The birds were observed singly and in small loose flocks following fishing boats. On one occasion a gathering of 50 or more was noted in association with Caspian Terns on a mudbank in an inundated field by the margin of the backwaters. From the bill and gullet of No. 300 were recovered 9 sword-fishes (*Hemirhamphus xanthopterus* C.V.) each from 190-200 mm. long and weighing aggregately about 1 lb. From the gullet of No. 307 also 10 of these fishes were obtained, and it would appear that the food of this gull here consists largely of this species.

According to Ferguson (*J.B.N.H.S.*, xvi, 11) this gull reaches the Travancore coast on winter immigration not much earlier than January. During this month in 1903, his collectors shot 5 specimens at Kayankolam Bar.

Larus ridibundus Linn. The Black-headed Gull.

Specimen not obtained.

Noted (?) at: Vembanād Lake near Alleppy, Cochin Harbour.

Ferguson (*J.B.N.H.S.*, xvi, 11) writes that this gull was found by his collectors to be fairly common about Kāyankolam Bar in January 1903, but apparently no specimens were procured by them.

Larus brunnicephalus Jerdon. The Brown-headed Gull.

Specimen not obtained.

Noted (? this or *ridibundus* or both) near Alleppey and in Cochin Harbour in January and February. At the latter place they were observed in association with *Gelochelidon nilotica* feeding on floating garbage and human ordure from the town.

Ferguson (*J.B.N.H.S.*, xvi, 12) secured a specimen on the sandy banks of a shallow lake close to the sea near Cape Comorin in December (1901). He found numbers of these gulls surrounding fishermen drawing their nets.

Larus fuscus taimyrensis Buturlin. The Eastern Herring Gull.

Not met with by the Surveys.

Ferguson's collectors obtained a single specimen at Kāyankolam in January 1903 (*J.B.N.H.S.*, xvi, 12) which was recorded as *Larus affinis* and therefore presumably belonged to the above race.

FAMILY: STERNIDÆ.

Chlidonias leucopareia indica (Stephens). The Indian Whiskered Tern.

Specimen collected: 306 ♂ ad. 18-2-33 Vembanād Backwaters, Kōttayam.

Elsewhere noted at: Karūpadanna (unconfirmed).

Colours of bare parts: Iris dark greyish-brown; bill dark reddish-brown; legs and feet dark coral brown; soles brighter coral; claws black.

[Measurements: Bill 35.5; Wing 222; Central tail 67; Outer tail 79; Tarsus 21.5 mm. As shown in the E. Ghats Survey (*J.B.N.H.S.*, xxxix, 247) Ceylon birds treated as *C. l. leggei* in the *Fauna*, are not separable from Indian specimens. The bird is not of course known to breed in Ceylon which is evidently visited by our North Indian breeding birds.—H. W.]

I only came across this tern—in fair numbers—in the backwaters where they were commonly seen following fishing boats or perched on stakes and dykes, close to the sea. Ferguson (*J.B.N.H.S.*, xvi, 12) describes it as abundant in North Travancore in the winter months, frequenting the coast, the backwaters and paddy fields.

It is a common (winter) visitor to Ceylon.

Hydroprogne caspia caspia (Pall.) The Caspian Tern.

Specimens collected : 309 ♀ ad., 310 ♀ ad. 18-2-33 Vembanād Backwaters, Kōttayam.

Elsewhere not noted.

Colours of bare parts : Iris dark brown ; bill bright orange-scarlet, duskier near tips ; mouth orange-scarlet, gullet paler ; legs, feet and claws black.

[Measurements :

	Bill.	Wing.	Tail.	Tarsus.
2 ♀♀ ad.	76-77	390-398	136-138	45 mm.—H. W.]

Several of these large terns were observed in association with Great Black-headed Gulls on a mudflat in the midst of inundated backwater paddy fields, not far from Alleppey. Ferguson (*J.B.N.H.S.*, xvi, 12) found it in fair numbers at Kāyankolam Bar in January 1903.

It is a fairly common visitor to the north coast of Ceylon during the North-East Monsoon, and a few remain behind to breed.

Gelochelidon nilotica nilotica (Gmelin). The Gull-billed Tern.

Specimens collected : 1037 ♂ ad., 1038 ♀ ad. 29-12-33 Karūpadanna (Backwaters).

Elsewhere noted : Cochin Harbour.

Colours of bare parts : ♂ (1037) ; Iris dark brown ; bill, legs, feet and claws brownish-black ; mouth orange-pink, ♀ (1038) legs and feet orange-brown, rest as above.

[Measurements :

	Bill.	Wing.	Tail.	Tarsus.
1 ♂	49·5	322	125	35·5 mm.
1 ♀	43·5	316	92	33 mm.—H. W.]

Small flocks of the Gull-billed Tern were observed about the inundated paddy cultivation and cocoanut fibre pans along the backwaters. In Cochin Harbour, several were seen flying about in company with gulls, feeding on the floating human ordure washed out from the town. The stomachs of the specimens contained remains of shrimps and other crustaceans.

Ferguson (*J.B.N.H.S.*, xvi, 12) describes this tern as fairly common in winter about the backwaters of North Travancore, and also frequenting the coast at Manakolam Bar.

It is common in Ceylon during the North-east Monsoon, but a few may be seen throughout the year.

Thalasseus bergii velox (Cretzsch.) The Red Sea Large Crested Tern.

Specimens collected : 1007 ♂ add., 1008 ♀ imm. 25-12-33, 1036 ♂ imm. 29-12-33 Karūpadanna Backwaters.

Elsewhere not noted.

Colours of bare parts : 1007 & 1008 ; Iris dark brown ; bill greenish lemon yellow ; legs, feet and claws brownish-black. 1036 : Iris shot damaged ; bill creamy greenish-yellow ; legs and feet greenish yellow, irregularly blotched with black ; claws horny brown.

[As shown in the Eastern Ghats Survey (*J.B.N.H.S.*, xxxix, 248) I am not able to recognise the supposed Ceylon race *T. b. edwardsi.*

Measurements :

	Bill.	Wing.	Central Tail.	Outer Tail.	Tarsus.
1 ♂ ad.	72·5	342 (worn)	89	180	31 mm.
1 ♂ imm.	67	339	85	136	28 mm.
1 ♀ imm.	67·5	348 (worn)	91	167	31 mm.—H. W.]

These terns— in fair numbers—were observed singly, perched on fishing stakes etc. in the backwaters, close to the sea.

Ferguson (*J.B.N.H.S.*, xvi, 12) found numbers at Kāyankolam Bar (ca. 9° 10′ N×76° 30′ E) and further north in December and January (1903-4).

It is common in Ceylon and breeds in the Gulf of Manaar.

Thalasseus bengalensis bengalensis (Lesson). The Indian Lesser Crested Tern.

Specimens collected : 301 ♂ ad. 17-2-33 Vembanād Backwaters, Kōttayam ; 1049 ♂ ad. 31-12-33 Karūpadanna Backwaters.

Elsewhere not noted.

Colours of bare parts : Iris dark brown ; bill chrome yellow ; palate same ; gullet pale flesh colour ; legs and feet brownish-black ; soles yellow ; claws blackish-brown.

[Measurements :

	Bill.	Wing.	Central Tail.	Outer Tail.	Tarsus.
2 ♂♂ ad.	63	280-6 (worn)	65-71	130-40	25-26 mm.—H. W.]

Several of these terns were observed following fishing boats or perched on fishing stakes in the backwaters, close to the sea, frequently in association with *T. bergii* and *Gelochelidon nilotica.*

According to Ferguson (*J.B.N.H.S.*, xvi, 12) it is the commonest and most abundant of the terns in Travancore, frequenting the backwaters and coast from Quilon northwards.

It is common all round the coast of Ceylon in the North-east Monsoon.

Sterna hirundo Subsp. ? The Common Tern.

Specimens not obtained.

Several noted flying up and down the Ponnāni River at Shoranūr on the northern boundary of Cochin—29-11-33. Nowhere else (This or *S. aurantiaca* Gray ?).

According to Ferguson (*J.B.N.H.S.*, xvi, 13) who seems to have taken a few immature specimens, this tern is an occasional winter visitor to the coast of South Travancore. He had not met with it in North Travancore at all.

Sterna albifrons saundersi Hume. The Black-shafted Ternlet.

Not met with by the Surveys.

Ferguson records a single specimen shot on the coast of North Travancore in January 1903.

Sub-Order : Limicolæ.

Family : Charadriidæ.

Sub-Family : Pre-Charadriinæ.

Arenaria interpres interpres (Linn.). The Turnstone.

Specimens collected : 525 ♀, 526 ♂, 527 ♀ 7-4-33 Cape Comorin, S.L.

Elsewhere not noted.

Colours of bare parts : Iris brown ; bill dark horny brown ; legs and feet bright reddish orange ; claws horny black.

[Measurements :

	Bill.	Wing.	Tail.	Tarsus.
1 ♂	26	152	60	25.5 mm.
2 ♀♀	25-26	154-8	61.5-64	24.5-26 mm.—H. W.]

A flock of about 15 birds was seen amongst rocks on the sea-shore, feeding on barnacles (?) and minute crustaceans. The specimens were undergoing heavy body moult into breeding plumage. Their wing- and tail-quills were fresh. They were very fat and evidently preparing to emigrate shortly.

The Turnstone has apparently not been recorded from Travancore previously, although it is a fairly common winter visitor to Ceylon.

Leucopolius alexandrinus alexandrinus (Linn.). The Kentish Plover.

Specimens collected ; 703 ♂ 21-7-33 Beach, Trivandrum ; 1000 ♀ imm., 1010 ♀ imm. (?), 1011 ♀ ad. 25-12-33 Karūpadanna, ca. S.L.

Elsewhere not noted.

Colours of bare parts : Iris dark brown ; bill blackish-brown, paler at chin ; legs brownish-grey ; feet greyish-brown ; claws horny black. (No. 703 'Iris dark brown ; bill slaty ; legs and feet light straw ; claws slaty' (Pillai).

[Measurements :

	Bill.	Wing.	Tail.	Tarsus
3 ♀♀	20-21	106-114.5	42.5-49	27.5-28 mm.

The 3 females, Nos. 1009-1011, undoubtedly belong to the typical race from which they can be distinguished neither in colour nor in size. They were doubtless winter visitors to Travancore. No. 703 on the other hand is a smaller bird (Bill 18 ; Wing 150 ; Tail 46.5 ; Tarsus 27.5) and would appear to be a juvenile of a local breeding form. The Kentish Plover has not yet been otherwise recorded as breeding in Travancore, but if it does breed there I have little doubt that the breeding form will prove to be *L. a. leggei* as in Ceylon.—H. W.]

Small flocks of the Kentish Plover were observed on a sand-bar separating the backwaters from the sea. Ferguson (*J.B.N.H.S.*, xvi, 8) found this species to be fairly numerous at Neendakaray on the coast near Quilon, in January. The smaller race, *L. a. leggei,* breeds in Ceylon.

Haematopus ostralegus ostralegus Linn. The Oyster-Catcher.

Not met with by the Surveys. According to Ferguson (*J.B.N.H.S.*, xvi, 9) this is a more or less rare winter visitor to the Travancore coast, found generally in small flocks of half a dozen or so, feeding on crustaceans mostly.

SUB-FAMILY : CHARADRIINÆ.

Charadrius dubius [jerdoni (Legge).] Jerdon's Little Ringed Plover.

Specimens collected : 512 ♀ 5-4-33 Vellayāni Lake, Trivandrum Environs ; 549 ♀ 9-4-33 Cape Comorin ca. S.L. ; 699 ♂ imm. 21-7-33, 766 ♂ imm. 1-8-33 Beach, Trivandrum ; 1006 ♀ 25-12-33 Karūpadanna ca. S.L.

Elsewhere noted at : Kūmili, by margin of Periyār Like (ca. 3,000 ft.).

Colours of bare parts : Iris brown ; ring round eye (eyelids) yellow ; bill horny black, yellow at chin ; legs and feet dusky greenish-yellow in No. 1006 (pale yellowish-flesh with pinkish tinge) ; claws horny black.

[Measurements :

	Bill.	Wing.	Tail.	Tarsus.
1 ♂ ad.	18.5	117	58	25 mm.
1 ♂ juv.	15	108	moult	25 mm.
2 ♀♀ ad.	15-17.5	114	55-57	23-24 mm.
1 ♀ juv.	18	119	59	25 mm .

I find considerable difficulty in identifying these birds for the reason that I have not been able—for lack of material—to decide whether *C. d. jerdoni* is a good race, and if so what are its limits of variation in size and colour. There is only one unsexed Ceylon bird in the British Museum (Bill 18 ; wing 117 mm.).

There is much variation throughout India in the size of Little Ringed Plovers and I am far from satisfied that *jerdoni* is separable from *curonicus*. Should it be so separable, the probability is that the Travancore birds should be attributed to the former race as they were evidently on their breeding ground, but it will be noted that their measurements, agreeing with the single Ceylon specimen, fall within the limits commonly attributed to *curonicus*. —H. W.]

These little plovers were met with in pairs or small parties about the margins of tanks and streams, and on marshy grassland by paddy fields etc. Ferguson (*J.B.N.H.S.*, xvi, 8) did not believe it to be a resident species in Travancore, but I think it is more than likely that some at any rate breed here. Mr. Pillai found the birds fairly common about the Trivandrum beach during July and August. Both the specimens obtained by him then were juvenile with imperfectly ossified skulls and undergoing complete post-juvenal moult.

No specific instance of its breeding in Travancore or Cochin has hitherto been recorded, however.

Cirrepedesmus mongolus atrifrons (Wagler). The Pamirs Lesser Sand-Plover.

Specimens collected : 523 ♀, 524 ♀ 7-4-33 Cape Comorin ca. S.L.

Elsewhere not noted.

Colours of bare parts : Iris brown ; bill black ; mouth pinkish-grey ; legs greenish-grey ; feet and claws blackish-brown.

[Measurements :

	Bill.	Wing.	Tail.	Tarsus.
2 ♀♀	21-22.5	126.5-127	46-46.5	33 mm.

Additional specimen seen. *Van der Sleem Coll.* : o 7-9-1926 Travancore, west of Parasala.—H. W.]

A flock of about 25 birds was met with on the sea-shore. They flew in close formation, turning and twisting on the wing in orderly fashion, all together and as one bird. Ferguson (*J.B.N.H.S.*, xvi, 8) describes this Sand-Plover as a winter visitor to the Travancore coast, but sometimes found inland, one specimen even being obtained on the High Range at 6,000 ft. elevation !

Cirrepedesmus leschenaultii (Lesson). The Large Sand-Plover.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xvi, 8) says ; 'A rare winter visitor to the coast. A single specimen was shot at Neendakaray near Quilon.'

Pluvialis dominicus fulvus (Gmelin). The Eastern Golden Plover.

Specimen not obtained.

Noted (unconfirmed) at : Kōttayam. A flock of 4 birds flying across the Vembanād Lake, 15-2-1933.

Ferguson (*J.B.N.H.S.*, xvi, 8) says : 'Flocks of these plovers may be met with commonly in North and Central Travancore, about Cherayankie, Parur and Vycome in winter, frequenting swampy flats and in paddy fields.'

SUB-FAMILY : VANELLINÆ.

Chettusia gregaria (Pallas). The Sociable Lapwing.

Not met with by the Surveys.

In January 1900, Ferguson (*J.B.N.H.S.*, xvi, 8) shot 2 specimens from a flock of 5, feeding in some paddy fields near Trivandrum. He thought that the failure of the monsoon in the north the season before and the consequent drought may have driven the birds so far south of their accustomed winter range in India.

Lobivanellus indicus (Boddaert). The Indian Red-wattled Lapwing.

Specimen collected : (not sexed) 9-12-33 Nemmāra 300 ft. (Preserved in alcohol for morphological study).

Elsewhere noted : Thattakād (200 ft.) ; Wadakkāncheri (400 ft.) ; Karūpadanna ca. S.L.

Colours of bare parts : Iris brown ; eyelids and wattles cherry red ; bill terminal 1/3 black, basal 2/3 cherry red ; legs and feet greenish-yellow ; claws horny black.

The Red-wattled Lapwing was commonly, but not abundantly, met with in the low country of Travancore and Cochin—in pairs or small (family?) parties, by streams, tanks and swampy fields etc.

In the Palni Hills, Terry (*S.F.*, x, 480) heard this lapwing calling overhead at night at Pittur, but never saw it.

Breeding : The season in Travancore according to Ferguson (*J.B.N.H.S.*, xvi, 7) is March.

Lobipluvia malabarica (Boddaert). The Yellow-wattled Lapwing.

Specimens collected : 587 ♀, 588 ♂ 13-4-33 Cape Comorin ca. S.L. ; 769 ♀ 2-8-33 Golf Links, Trivandrum.

Elsewhere noted at : Wadakkāncheri (400 ft.) ; Karūpadanna ca. S.L.

Colours of bare parts : Iris dark khaki ; bill terminal 2/3 brownish-black, basal 1/3 greenish yellow ; circumorbital ring (eyelids), gape and wattles greenish- or sulphur-yellow ; legs and feet greenish-yellow ; claws brownish-black, [Additional specimens seen : *Brit. Mus. Coll.* : ♂ 20-6-77 Trivandrum (Hume Coll.); 0-1-73 Kolachul (Bourdillon).

Measurements :

	Bill.	Wing.	Tail.	Tarsus.
2 ♂♂ ad.	26-28	186-188	72-73·5	59·5-63 mm.
2 ♀♀ ad.	27·5-29	185-196	75·5-78	58-60 mm.
1 ♀ juv.	...	178	73	... mm.—H. W.]

This lapwing is also fairly common in the low country of both Travancore and Cochin. *Nidification* (iv, 401) describes it as 'extraordinarily common' (in Travancore), which is perhaps an overstatement of the case. The birds were observed in pairs or small parties of 4 or 5, frequenting open fallow land and ploughed and stubble fields—altogether drier facies than the foregoing.

It is a resident species in Ceylon.

Breeding : Specimen No. 587 (13 April) had a mature ovary with some of the follicles measuring 4 mm. in diameter. The testes of the male measured about 6×4 mm. and were evidently enlarging. Both these birds were in fresh plumage and doubtless preparing to breed. In the August specimen the ovary was in a quiescent state.

Bourdillon *Nidification*, iv, 401) found this lapwing breeding in Travancore from 3 March to 13 August : Stewart from 4 April to 6 August. The full clutch of eggs is said to be 4, but sometimes only 3 are laid.

A remarkable case of colour adaptation of eggs to environment, revealed by J. Stewart in Travancore, has been described by Mr. Stuart Baker in the Society's *Journal* (xxxv, 250). Stewart, it seems, took numerous clutches of the eggs of this bird on red laterite as well as on adjoining black soil. Practically every clutch found on laterite soil was erythristic and every clutch on the black soil normally coloured.

Family : Scolopacidæ.

Sub-Family : Tringinæ.

Numenius arquata (Linn.) subsp.? The Curlew.

Not met with by the Surveys.

According to Ferguson (*J.B.N.H.S.*, xvi, 9) the Curlew is found on the Travancore coast in winter, but not in any great numbers.

Numenius phæopus (Linn.) subsp.? The Whimbrel.

Not met with by the Surveys.

In Travancore, Ferguson writes (*J.B.N.H.S.*, xvi, 9) that it may be found in suitable places along the coast in fair numbers from October to April, usually as a solitary bird.

Tringa ochropus Linn. The Green Sandpiper.

Specimens collected : 174 ♂ 28-1-33 Sānthanpāra 3,000 ft. (Cardamom Hills).

Elsewhere noted at : Mūnnār (5,000 ft.); Kūmili (3,000 ft.); Vellayani Lake, Trivandrum Environs; Nemmāra (300 ft.).

Colours of bare parts : Iris brown; bill greenish-brown, duskier near tip, greener near base; legs and feet greyish sage green; claws horny brown.

[Measurements :

	Bill.	Wing.	Tail.	Tarsus.
1 ♂	39·5	143	59	34 mm.—H. W.]

The Green Sandpiper was met with by the Surveys singly and sparingly, by streams, tanks and puddles, both in the low country and the hills—up to about 5,000 ft. Ferguson (*J.B.N.H.S.*, xvi, 9) shot an example at a swamp on the High Range at an elevation of 6,000 ft. in January. Like all other sandpipers, it is of course only a winter visitor to our area, as it is to Ceylon.

A specimen ringed by the Russians in the environs of the city of Kazan (55°48′N×49°26′E) in June 1929 was recovered near Kōttayam in September 1933. The distance between these two points is 3,500 miles.

In the Palni Hills, Terry (*S.F.*, x, 480) shot one in the Pittur Valley as late as 4 May.

Tringa glareola Linn. The Wood Sandpiper.

Specimen collected : 1046 ♂ 30-12-33 Karūpadanna ca. S.L.

Elsewhere noted at : Cape Comorin, Nemmāra (300 ft.).

Colours of bare parts : Iris dark brown ; bill basal half olive-brown ; terminal half blackish-brown ; legs and feet olive green ; claws horny-brown.

[Measurements :

	Bill.	Wing.	Tail.	Tarsus.
1 ♂	34	127	49	36.5 mm.—H. W.]

Wood-Sandpipers were met with in the low country of Travancore and Cochin in small loose flocks—on one occasion of over 20 birds—on swampy or inundated ploughed fields by irrigation tanks and along the backwaters.

Ferguson writes (*J.B.N.H.S.*, xvi, 9) that this is by far the commonest of the sandpipers (in Travancore) and may be found in abundance in the wet paddy fields from August to May, either solitary or in flocks.

Tringa stagnatilis (Bechstein). The Marsh Sandpiper.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xvi, 9) states that his collectors found flocks on the seashore at Manakolam Bar and at North Parur in Travancore, presumably in winter.

Tringa hypoleucos Linn. The Common Sandpiper.

Specimen collected : 489 ♀ 24-3-33 Tenmalai ca. 500 ft.

Elsewhere noted at : Mūnnār (on Mūnnār stream 5,000 ft.) ; Thattakād (on Periyār river, 200 ft.) ; Kōttayam (backwaters) ; Camp Derāmalai (at Uppukulam tank among grassy hiltops, 4,000 ft.) ; Periyār Lake margin (ca. 3,000 ft.) ; Vellayani Lake, Trivandrum Environs ; Cape Comorin ; Arāmboli (250 ft.) ; Kūriārkūtti (1,600 ft. on Parambikolam river) ; Wadakkāncheri (400 ft.), Nemmāra (300 ft.) ; Ernākulam (backwaters).

Colours of bare parts : Iris brown ; bill greenish-brown, duskier near tip, greener near base ; legs and feet greyish sage-green ; claws horny brown.

[Measurements :

	Bill.	Wing.	Tail.	Tarsus.
1 ♀	29	112	56	24 mm.—H. W.]

In winter, the Common Sandpiper is widely distributed but not abundant in Travancore and Cochin. It was met with solitary as a rule on streams, tanks, puddles, the rocky sea-shore and by the backwaters. According to Ferguson it is common in Travancore from September to May.

It is a winter visitor also to Ceylon.

Tringa totanus (Linn.). The Redshank.

Specimen not obtained.

Noted only at Karūpadanna along the backwaters where it was uncommon. Occasional solitary birds were observed feeding on mudbanks etc. and their familiar call uttered in flight, *Tew-tew-tew* was frequently heard at night. A single specimen was shot by Ferguson's collectors at Neendakaray (near Quilon) in January 1903 (*J.B.N.H.S.*, xvi, 10).

Glottis nebularia (Gunnerus). The Greenshank.

Specimen not obtained.

Noted only at Karūpadanna, usually solitary, on mudbanks in the backwaters. Uncommon. Ferguson (*J.B.N.H.S.*, xvi, 10) says that he did not meet with this species in South Travancore, but that his collectors saw flocks on the sides of the rivers and in marshes in North Travancore. They obtained specimens at Yettamane, Shertally and Vycome.

SUB-FAMILY EROLIINÆ.

Erolia minuta [minuta (Leisler)]. The Little Stint.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xvi, 10) describes it as 'A fairly common visitor to the coast of North Travancore in winter, but not found inland. It often associates with *Tringa subarquata* [=*Erolia testacea*]. It forms larger flocks, as a rule, than other stints.'

Erolia testacea (Pallas). The Curlew-Stint or Pigmy Sandpiper.

Not met with by the Surveys.

According to Ferguson (*J.B.N.H.S.*, xvi, 10) 'This fine stint is found from October to April on the coast of North Travancore, especially about Manakolam Bar. When it associates with *T. minuta*, only a few individuals are found, but it forms flocks of from 8 to 12 when alone.'

Limicola falcinella falcinella (Pontopp.). The Broad-billed Sandpiper.

Not met with by the Surveys.

A single specimen was obtained by Ferguson's collectors at Manakolam Bar in January 1903 (*J.B.N.H.S.*, xvi, 10).

SUB-FAMILY : SCOLOPACINÆ.

Scolopax rusticola rusticola Linn. The Woodcock.

Not met with by the Surveys.

Ferguson writes (*J.B.N.H.S.*, xvi, 10) 'Occasional specimens of this bird may be met with in grassland bordered by forest in South Travancore at elevations of about 4,000 ft. in winter. On the High Range in similar localities before the forest was cut down for tea and coffee cultivation it used to be fairly common at this period.'

In the Nelliampathy Hills, Kinloch (*J.B.N.H.S.*, xxvii, 943) describes the Woodcock as very rare and presumably a passage migrant at the end of September and the beginning of October, and again early in March.

In the Palnis, Fairbank (*S.F.*, v, 408) flushed one in the Kodaikanal in 1867, and records another shot in the same locality subsequently. He says that they are rare on those hills.

Capella nemoricola (Hodgson). The Wood Snipe.

Not met with by the Surveys.

In Ferguson's time, the Trivandrum Museum contained a single specimen shot on the High Range of Travancore (*J.B.N.H.S.*, xvi, 10).

Capella gallinago gallinago (Linn.). The Common or Fantail Snipe.

Specimen not collected.

Noted (unconfirmed) at : Māraiyūr (3,000 ft.) ; Kōttayam (Munro Island, Vembanād Backwaters) ; Trivandrum Environs (Vellayani Lake) ; Karūpadanna.

The birds were met with in swampy stubble paddy fields along the backwaters and inland. My impression is that it is less common and abundant in Travancore and Cochin than the Pintail Snipe. According to Ferguson (*J.B.N.H.S.*, xvi, 11) this species forms about ¼ or 1/3 of the bag in a day's snipe-shooting. In North Travancore he was told the proportion is higher. He says that it arrives in Travancore later than the Pintail and leaves earlier.

In the Palni Hills, both Fairbank and Terry found this snipe in small numbers in the cold season at the western end of the Kodaikanal Lake and in other swampy places. Terry shot 4 birds on 3 April, and the last seen by him was on 4 May.

Capella stenura (Bonaparte). The Pintail Snipe.

Specimens collected : 114 ♀ 19-1-33 Mūnnār 5,000 ft. (Kanan Devan Hills) ; 294 ♀ 17-2-33 Munro Island (Vembanād Backwaters) ; 414 ♀ 7-3-33 Kūmili 3,000 ft. (Periyār Lake margin).

Elsewhere noted at : Camp Derāmalai ('Single at Uppukulam tank among grassy hilltops 4,000 ft.') ; Cape Comorin ; Karūpadanna.

Colours of bare parts : Iris brown ; bill horny brown, darker at tip, pale greenish at chin and base of lower mandible ; legs and feet greyish green ; claws dark brown.

[Measurements :

	Bill.	Wing.	Tail.	Tarsus.
3 ♀♀	66.5-73.5	132-137	48-51	33-35.5 mm.—H. W.]

The Pintail Snipe is a common and fairly abundant winter visitor to Travancore and Cochin. It was met with principally in and about marshy stubble fields along the backwaters, but in smaller numbers wherever there was any grassy marsh—in the low country as well as on the hills. The birds were plentiful on Munro Island (Vembanād Lake) among the cut paddy fields and by the grass-fringed cocoanut irrigation trenches, and afforded good sport. Ferguson says (*J.B.N.H.S.*, xvi, 11) that in Travancore a few stragglers arrive early in September and that a few belated individuals may be found at the end of April. The last date on which one was shot by the Travancore Survey was 10 April (Cape Comorin). The bird was then undergoing heavy body moult. The specimen of 17 February was also in heavy body moult, while that of 7 March was moulting its rectrices. The Pintail Snipe is an abundant winter visitor to Ceylon.

Lymnocryptes minima Brunnich. The Jack Snipe.

Not met with by the Surveys.

Ferguson writes (*J.B.N.H.S.*, xvi, 11): 'A few specimens of this little snipe used generally to be found solitary from year to year on certain damp rushy ground in Trivandrum; since this has been taken into cultivation, I have not met with any more.'

According to Fairbank (*S.F.*, v, 410) the Jack Snipe visits the Palni Hills in the cold weather in small numbers, being found at the west of the Kodaikanal Lake and in other swampy places.

ORDER: STEGANOPODES.

FAMILY: PELECANIDÆ.

Pelecanus philippensis Gmelin. The Spotted-billed Pelican.

Not met with by the Surveys.

Ferguson did not secure a specimen, but says (*J.B.N.H.S.*, xvi, 13) that this Pelican occurs in South Travancore and that he once saw 3 flying over the parade ground in Trivandrum.

FAMILY: PHALACROCORACIDÆ.

SUB-FAMILY: PHALACROCORACINÆ.

Phalacrocorax niger Vieillot. The Little Cormorant.

Specimen not collected.

Noted only on the Ponnāni river at Shoranūr (North Cochin)—a flock of over 30 birds sunning themselves, wings outspread, on a sandbank in the afternoon.

Ferguson (*J.B.N.H.S.*, xvi, 13) observed this cormorant on the tanks and lakes in and about Nagercoil in South Travancore.

It is doubtless a resident species in our area, but nothing appears to be recorded about its breeding here.

SUB-FAMILY: ANHINGINÆ.

Anhinga melanogaster Pennant. The Indian Darter or Snake-Bird.

Specimen not obtained.

Noted at: Thattakād (200 ft.—Periyār river); Kūmili (3,000 ft.—Periyār Lake); Kūriārkūtti (1,600 ft.—Parambikolam river).

The Darter is a fairly common but not abundant resident species in Travancore and Cochin. It was usually met with solitary or in twos and threes on rivers and tanks. On the Periyār Lake, the exposed tops of the submerged tree-trunks seemed to provide favourite perches for these birds for sunning themselves, and as look-out posts.

Breeding: Ferguson points out (*J.B.N.H.S.*, xvi, 13) that in Travancore it breeds in September as in Northern India, and not in February as it does in Madras and Ceylon. T. F. Bourdillon found a colony nesting on small trees on an island in the Kodasheri river above the Athirapuzha fall in September. The nests then contained fresh and hard-set eggs in all stages, as well as half-fledged young.

FAMILY: FREGATIDÆ.

Fregata andrewsi Mathews. The Christmas Island Frigate-Bird.

Not met with by the Surveys.

Ferguson writes (*J.B.N.H.S.*, xvi, 13): 'A young bird of this species taken at Perumathoray, about 10 miles from Trivandrum, was brought to me alive.'

Another specimen obtained at Quilon was sent to the Bombay Natural History Society in July 1928 by Mr. L. A. Lampard. It was caught in a fishing net in a rough sea at the onset of the monsoon (*J.B.N.H.S.*, xxxiii. 445). It would appear, therefore, that it is not unusual for these birds to be blown ashore periodically by the violent gales of the south-west monsoon.

ORDER: TUBINARES.

Puffinus persicus Hume. The Persian Shearwater.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xvi, 14) states that a specimen taken at Valey (Veli) four miles from Trivandrum, was brought to him alive. Unfortunately no date is given.

ORDER: HERODIONES.

FAMILY: IBIDIDÆ.

Threskiornis melanocephalus (Latham). The White Ibis.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xvi, 14) came across the White Ibis only during the cold weather at Sāstancōttah, and was doubtful about the bird being a resident in Travancore. He says the birds were feeding by day in the paddy fields and roosting in trees on the bank of the lake, and that they were wary and difficult to approach.

SUB-ORDER: CICONIÆ.

Dissoura episcopa episcopa (Boddaert). The White-necked Stork.

Specimen not obtained.

Noted at: Thattakād (200 ft.); Wadakkāncheri (400 ft.); Shoranūr (Ponnāni river).

These storks were observed on a few occasions in pairs or small parties of 4 or 5, in the neighbourhood of water either soaring in circles at great height or feeding on sandbanks etc. in association with egrets.

Ferguson (*J.B.N.H.S.*, xvi, 14) mentions a specimen in the Trivandrum Museum from Palode, and another brought alive to him from Nagercoil.

Leptoptilos javanicus (Horsfield). The Smaller Adjutant.

Specimen not obtained.

Noted at: Kūriārkūtti (1,600 ft.—Annemalai Hills, Cochin). A pair on an open marshy patch amidst mixed deciduous and bamboo jungle (15 and 18 November 1933); very shy.

According to Ferguson (*J.B.N.H.S.*, xvi, 14) this Adjutant is by no means common in Travancore, but may be found about the tanks in S. Travancore whence live specimens were brought to the Trivandrum Zoo from time to time.

Anastomus oscitans (Bodd.). The Open-bill.

Ferguson (*J.B.N.H.S.*, xvi, 15) describes the Open-billed Stork as very common in Travancore, where large flocks may be met with on the marshy borders of all the larger tanks and fresh-water lakes, sharing the trees for roosting with flocks of Darters.

Curiously enough the Surveys altogether failed to come across the species in Travancore or Cochin.

Breeding: Ferguson did not take eggs, but he believed that the breeding season in Travancore was in June. No confirmation is available.

SUB-ORDER: ARDEÆ.

FAMILY: ARDEIDÆ.

Ardea purpurea manillensis Meyen. The Eastern Purple Heron.

Specimen not obtained.

Noted in small numbers, usually solitary, on the reedy margins of the backwaters at Kōttayam (Vembanād) and Karūpadanna.

Long ago F. W. Bourdillon found the Purple Heron abundant at the Vellayani Lake, 7 miles from Trivandrum, but even in 1904 Ferguson pointed out (*J.B.N.H.S.*, xvi, 15) that since the reeds had been removed none were to be seen there. He saw and shot specimens at Sāstancōttah.

Breeding: In Travancore, Stewart and Bourdillon obtained fresh eggs between July and September (*Nidification*, iv, 456).

Ardea cinerea cinerea Linn. The Common Grey Heron.

Specimen not obtained.

Noted at Karūpadanna, Cochin State. A solitary bird (29 December) on a reed-covered islet in the backwaters.

In Travancore, according to Ferguson (*J.B.N.H.S.*, xvi, 15) the Grey Heron frequents the backwaters along the entire coast, but is not found in the interior. He mentions a specimen that had been living in the Trivandrum Zoo for over 17 years.

Egretta alba [modesta (Gray).] The Eastern Large Egret.

Specimen not obtained.

Noted only at Karūpadanna (Cochin). A solitary bird on a reed-covered mudbank in the backwaters.

Ferguson (*J.B.N.H.S.*, xvi, 15) writes that the Large Egret is by no means common in Travancore, and usually met with singly in inundated paddy fields. At Sāstancōttah he found them roosting gregariously on trees round the lake in association with Ibises and Snake-birds. He remarks that here the Egrets arrived long after the other birds had settled down for the night.

Breeding: No records relating specifically to our area are available.

Egretta intermedia intermedia (Wagler). The Indian Smaller Egret.

Specimen collected: 1025 ♂ 27-12-33 Karūpadanna (backwaters).

Elsewhere noted at: Kōttayam (Munro Island, Vembanād Lake); Shoranūr (on Ponnāni river); Nemmāra (300 ft.—by tanks and inundated paddy fields).

Colours of bare parts: Iris yellowish cream; bill lemon yellow, dusky at tip; lores and infra-orbital skin greenish-yellow; legs, feet and claws black.

[Measurements:

	Bill.	Wing.	Tail.	Tarsus.
1 ♂	94	302	121.5	111.5 mm.—H. W.]

The Smaller Egret is a fairly common but not abundant species about the backwaters of Cochin and Travancore. It also frequents tanks and inundated paddy cultivation inland. Solitary birds, pairs or small parties of 3 or 4 were usually seen. At Nemmāra I found them to be much persecuted by local 'sportsmen' armed with muzzle-loaders, and this is probably the case all over since the birds everywhere were inordinately wary.

This egret is a resident in Ceylon.

Breeding: Nothing appears to be published concerning its nidification in Travancore or Cochin, though it is doubtless a resident species.

Egretta garzetta garzetta (Linn.). The Little Egret.

Specimen not obtained.

Noted at: Kōttayam and Karūpadanna (backwaters). Shoranūr (on Ponnāni river).

The Surveys found the Little Egret somewhat commoner than the two foregoing, but on the whole far from abundant. It was usually seen in pairs or small parties—on one occasion a flock of 6 or 7.

Breeding: Nothing appears to be recorded from our area.

Bubulcus ibis coromandus (Bodd.). The Cattle Egret.

Specimen not obtained.

Noted sparingly along the railway line from Shoranūr to Chālakudi and in the low country of Cochin generally. Strangely enough I have no record of it from Travancore where Ferguson says (*J.B.N.H.S.*, xvi, 16) 'this is the commonest of the white egrets and may be found in numbers in all paddy fields throughout Travancore, along the backwaters and in cultivated land'. It would be worth investigating if the persecution I have referred to under *E. intermedia* may not have something to do with the discrepancy between Ferguson's account and my own recent experience of its status in Travancore.

Fairbank (*S.F.*, v, 410) records this egret from the base of the Palni Hills.

Breeding: Nothing recorded except Ferguson's statement that it assumes the breeding plumage about April. The birds must therefore evidently breed in Travancore at the commencement of the rains, as they do in most other areas of their distribution.

Demiegretta asha (Sykes). The Indian Reef Heron.

Specimen not obtained.

Noted at Karūpadanna, Ernākulam (backwaters).

Not common. Single birds were observed occasionally, perched on low fishing stakes and the posts marking the navigable channels in the backwaters. Ferguson (*J.B.N.H.S.*, xvi, 16) records that a single specimen was obtained by the Trivandrum Museum collectors at Ayrentenga, on the coast near Kāyankolum.

Breeding: Apparently not been recorded in Travancore or Cochin.

Ardeola grayii (Skyes). The Indian Pond Heron.

Specimens collected: 700 ♀ ad. 21-7-33, 775 ♂ juv. 3-8-33 Beach, Trivandrum.

Elsewhere noted at: Thattakād (200 ft.); Kōttayam (ca. S.L.); Kūmili and Periyār Lake Environs (ca. 3,000 ft.); Cape Comorin; along the railway line from Soranūr to Ernākulam; Kūriārkūtti (1,600 ft.—along Parambikolam river); Waddakkāncheri (400 ft.); Ponnāni river; Nemmāra (300 ft.); Karūpadanna (ca. S.L.).

Colours of bare parts: *Adult* (700): 'Iris yellow; bill marine blue at base, yellow at middle, black at tip; mouth chocolate brown; legs and feet pink; claws horny brown. *Immature* (775): Iris bright yellow; bill upper mandible blackish green, black at tip; commissure yellow; lower mandible greenish-yellow with a dark patch on either side near the tip; gape greenish-yellow; mouth bluish-flesh; legs and feet yellowish green; claws plumbeous.' (Pillai).

[Measurements:

	Bill.	Wing.	Tail.	Tarsus.
1 ♀ ad.	62	189	62	54 mm.
1 ♂ juv.	...	187	62	...

These two specimens are smaller than northern birds, but more require to be examined from Ceylon and South India before the possibility of there being 2 races can be settled.—H. W.]

The Pond Heron or Paddy Bird is a very common resident species throughout the low country of Travancore and Cochin and was also met with more sparingly in suitable localities up to at least 3,000 ft. elevation. It is found singly or in loose parties in the neighbourhood of streams, tanks, puddles and flooded paddy fields, both along the backwaters and farther inland.

In the Palni Hills, Fairbank (*S.F.*, v, 410) saw it by streams and ponds at the base.

Breeding: Mr. Pillai found the ovary of No. 700 (21 July) to be fully mature with the largest follicle measuring 12 mm. in diameter. The bird was undoubtedly breeding.

Nothing more seems to have been recorded in this area.

Butorides striatus javanicus (Horsfield). The Indian Little Green Bittern.

Specimen not obtained.

Noted at: Thattakād (200 ft.—Single on drift log in narrow wooded channel in Periyār river); Kūriārkūtti (1,600 ft.—Single among bushes on bank, overhanging Parambikolam river).

This Bittern is doubtless a resident species in our area, but its status is apparently somewhat indeterminate. In Travancore F. W. Bourdillon described it as a winter visitor, silent and solitary, and found from November to March among the rocks of the larger streams up to about 2,000 ft. elevation. Ferguson (*J.B.N.H.S.*, xvi, 16) found it common in the low country from November to April, but he did not meet with it at any other time of the year.

Breeding: In Travancore or Cochin, unrecorded.

Nycticorax nycticorax nycticorax (Linn.). The Night Heron.

Specimen not obtained.

Noted only at Shoranūr (North Cochin boundary)—a small colony roosting among vegetation overhanging the steep outscoured banks of the Ponnāni river, and flying out at dusk to feed.

Ferguson's collectors found this species fairly common at Perambulum in North Travancore and at other places round the Vembanād Lake where they are apparently protected by the inhabitants.

Breeding in Travancore or Cochin, unrecorded.

Gorsakius melanolophus melanolophus Raffles. The Malay Bittern.

Not met with by the Surveys.

Ferguson mentions (*J.B.N.H.S.*, xvi, 17) that F. W. Bourdillon obtained a specimen of the Malay Bittern on the hills at about 2,500 ft. elevation in 1878 and that subsequently he received 2 live specimens. Stewart seems to have found it common in Travancore (*Fauna*, vi, 362).

It has not been recorded from actually within the Cochin State, but it must doubtless occur there. Kinloch (*J.B.N.H.S.*, xxix, 294) obtained a specimen and found it common in the Nelliampathy valley. He also saw this Bittern at the foot of the Palghat Hills.

Breeding: *Nidification* (iv, 479) records that Stewart took many nests of the Malay Bittern in Travancore from the end of May to early July.

Ixobrychus sinensis sinensis (Gmelin). The Yellow Bittern.

Specimen collected: 417 ♂ 7-3-33 Kūmili 3,000 ft. (Periyār Lake).

Elsewhere not noted.

Colours of bare parts: Iris bright golden yellow; culmen horny brown; commissure and lower mandible pale yellowish-flesh; naked skin at gape under and around eyes pale greenish yellow; mouth pink; legs and feet greenish yellow; claws horny brown.

[Measurements:

Bill.	Wing.	Tail.	Tarsus.
68	139	47·5	51·5 mm.—H. W.]

The specimen was one of a pair among decaying bamboo root-clumps and brushwood in a swamp on the margin of Periyār Lake. When wounded, the bird got within a bamboo clump and stretching its neck and bill perpendicularly skywards, assumed the so-called 'On guard' attitude, standing perfectly motionless and making itself extraordinarily inconspicuous amongst the culms at 5 yards range!

Ferguson's collectors obtained several specimens of this Bittern in North Travancore where they reported it as being found solitary on the banks of the backwaters about Kōttayam and Vaikom (*J.B.N.H.S.*, xvi, 17).

Breeding: The testes of the specimen were in a quiescent state. Nothing recorded specifically for Travancore or Cochin.

Ixobrychus cinnamomeus (Gmelin). The Chestnut Bittern.

Specimen collected: 302 ♂ 17-2-33 Kōttayam (Munro Island, Vembanād Lake).

Elsewhere not noted.

Colours of bare parts: Iris bright golden yellow with a small crescent-shaped brown patch behind and half-encircling pupil; culmen horny brown; commissure and lower mandible greenish-yellow; mouth pink; legs and feet yellowish-green; claws horny brown.

[Measurements :

	Bill.	Wing.	Tail.	Tarsus.
1 ♂	58	155	47	53·5 mm.—H. W.]

The specimen, a solitary bird, was flushed from amongst rank grass and decaying brushwood in a marshy patch in cocoanut and paddy cultivation.

According to Ferguson (*J.B.N.H.S.*, xvi, 17) this little bittern is common throughout Travancore on all the lakes and backwaters, frequenting the canals cut through the ground laid out for the cultivation of young cocoanut palms.

It is a resident species in Ceylon.

Breeding: The testes of the specimen were quiescent. No records of its nidification in Travancore or Cochin are available.

Dupetor flavicollis flavicollis (Lath.). The Black Bittern.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xvi, 17) describes the Black Bittern as not uncommon along the backwaters in Travancore, frequenting the dense vegetation and screw-pine tangles on the banks of canals. He found it of crepuscular habits. Stuart Baker (*Fauna*, vi, 369 and *Nidification*, iv, 484) writes (on the same authority?) that it is comparatively common in Malabar and Travancore.

In the Palni Hills, Fairbank (*S.F.*, v, 410) says he twice came upon a Black Bittern when collecting ferns in the early part of 1867 below Vilpati. As no specimen was obtained by him and as he recognised the bird merely from the figure he had seen in Jerdon's Illustrations of Indian Ornithology, Pl. 16, this record must be accepted for what it is worth.

Breeding: Unrecorded from Travancore or Cochin.

ORDER: ANSERES.

FAMILY: ANATIDÆ.

SUB-FAMILY: CHENONETTINÆ.

Nettapus coromandelianus (Gmelin). The Cotton Teal.

Not met with by the Surveys.

In Travancore, Ferguson (*J.B.N.H.S.*, xvi, 18) believed the Cotton Teal to be a winter visitor only, and never abundant.

A. M. Kinloch (*J.B.N.H.S.*, xxvi, 674) saw four specimens which were shot near Kollengode, just outside Cochin boundary, at the end of 1918. He was informed that the species was not uncommon there.

Breeding: No record for this appears to be published.

SUB-FAMILY: ANSERINÆ.

Anser indicus Latham. The Bar-headed Goose.

According to Stuart Baker (*Fauna*, vi, 406) this Goose has been obtained in the Nelliampathy (Hills or Valley?) by Kinloch. No other information is available.

SUB-FAMILY: ANATINÆ.

Dendrocygna javanica (Horsf.) The Lesser or Common Whistling Teal.

Specimen not obtained.

Noted only at Kōttayam (February): 'A fair number amongst enormous flocks (several thousand) of mixed species, floating in masses on Vembanād Lake near Munro Island during daytime and feeding in the surrounding paddy fields at night. Much persecuted by gunners, and extremely wary.'

Ferguson writes (*J.B.N.H.S.*, xvi, 18): 'The Whistling Teal is common on all weedy tanks and lakes throughout Travancore. On one such piece of fresh water near Sāstancōttah, I saw hundreds in April 1902; but in December 1903, in the same place, not a single one was to be found. It is, perhaps, commoner in the North than in the South.'

Breeding: Nothing recorded from our area.

Nettion crecca crecca (Linn.). The Common Teal.

Specimen not obtained.

Noted only at Kōttayam. A few amongst the masses resting on the surface of Vembanād Lake (February). Ferguson (*J.B.N.H.S.*, xvi, 18) shot a single specimen of this teal in South Travancore. It is of course only a winter visitor.

Querquedula querquedula (Linn.). The Garganey or Blue-winged Teal.

Specimen not obtained.

Noted only at Kōttayam. The majority of massed wildfowl resting on the Vembanād Lake were undoubtedly this species. Here they were much harassed by local sportsmen and were, in consequence, excessively shy. The birds had studied to a nicety the art of keeping just out of shot-gun range. When approached closer, and unless fired at, those at the outer margin of the mass merely 'hopped' a few yards deeper into it, and so on continuously! Our motor boat passed 2 or 3 putrefying birds of this species floating on the water in the neighbourhood which had doubtless died of shot wounds.

Ferguson (*J.B.N.H.S.*, xvi, 18) says: Large flocks may be met with on the backwaters in North Travancore in winter.

Among the flocks, I think there were also a certain number of Gadwall (*Chaulelasmus streperus*), but owing to the distance this could not be definitely verified even with powerful field glasses.

SUB-FAMILY: NYROCINÆ.

Nyroca rufa rufa Linn. The White-eyed Pochard.

Specimen not obtained.

Noted at Kōttayam. I am almost certain that a large number of birds comprising the masses of wildfowl on Vembanād Lake (February) were of this species. Strangely enough it has not been previously recorded from Travancore or Cochin.

ORDER: PYGOPODES.

Podiceps ruficollis capensis Salvadori. The Indian Little Grebe.

Specimen collected: 550 ♀ 9-4-33 Cape Comorin ca. S.L.

Elsewhere noted at Nagercoil.

Colours of bare parts: 'Iris yellow; bill black above, green at gape, dull yellow on lower mandible, tip white; legs and feet black with greenish webs; claws whitish.' (Humayun Abdulali).

[Measurements: Bill 23, Wing 96, Tail 23, Tarsus 32 mm.—H.W.]

Pairs or small parties of the Little Grebe were observed on village tanks in South Travancore. They were not common.

Breeding: According to Ferguson (*J.B.N.H.S.*, xvi, 18) it breeds in Travancore in August.

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[The End].

BIRD LIFE ON A SOUTHERN INDIAN TANK.

BY

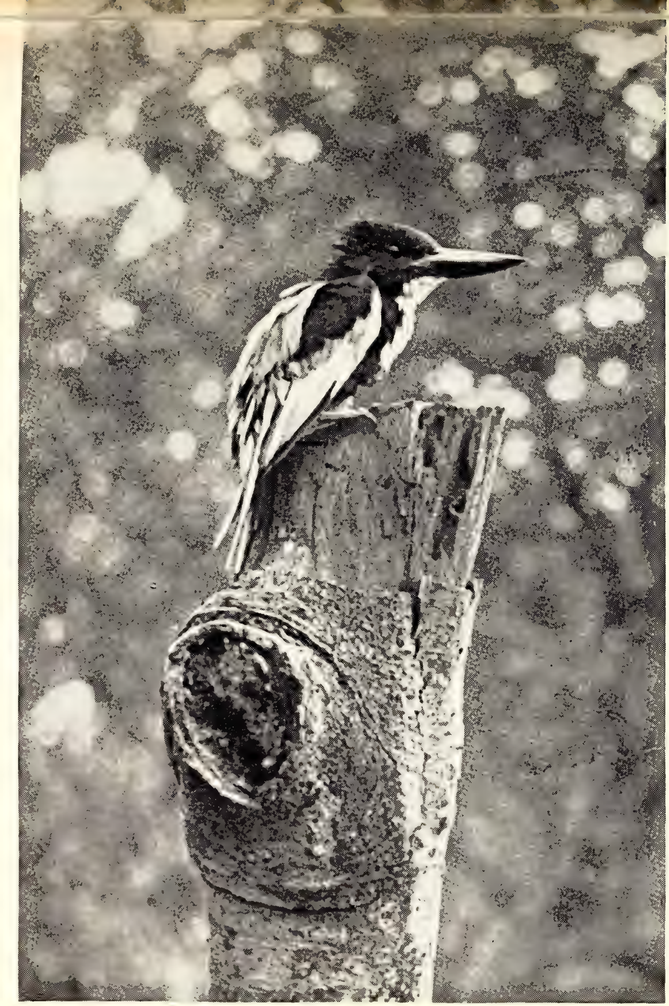
F. N. BETTS.

(*With two plates*).

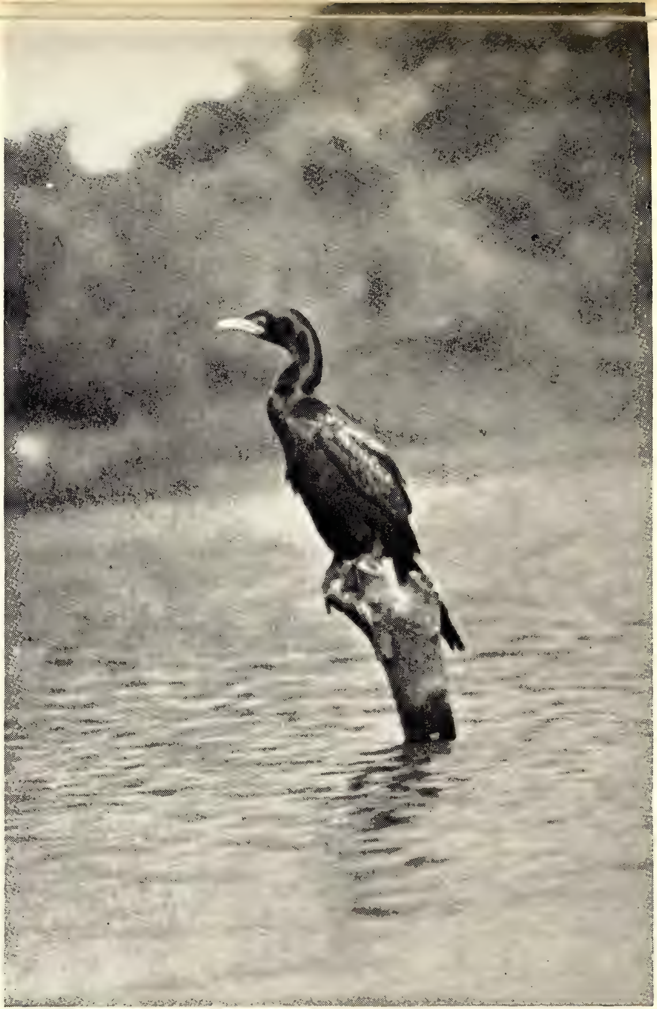
Waterfowl make a small showing in the list of Coorg birds owing to lack of conditions to suit them in the hilly country which comprises most of the area of this little province. Natural lakes there are none and the artificial tanks which are such a feature of the landscape in the plains are few and small and confined to the narrow strip of dry, low-lying country between the hills and the river Cauvery which here forms the Mysore boundary.

There is one however of considerable size which has long been a favourite haunt of mine. It lies between two low ranges of hills running north and south at a distance of a couple of miles, the furthest outposts of the Ghats. The more westerly of these, which is the higher, is buried from foot to summit in unbroken jungle except where the dominating peak of Jainkalbetta thrusts a bald head above the trees, while its counterpart is a mere ridge of rocky outcrop hardly a hundred feet high, sparsely grown with thorny scrub and a few stunted trees which have managed to gain a foothold in pockets of soil among the black stones. A shallow vale separates the two, mostly open maidan interspersed with patches of scrub, merging at its upper end into the jungle and at the lower cut off from the tank by a belt of trees, bamboos, date palms and tall banyans and tamarinds, the lantana growing thick about their bases making an almost impenetrable barrier except where the cattle tracks pierce their way.

My first visit was on an afternoon in July. There was a lull in the monsoon and though the main ranges on the western horizon were veiled in mist, here on the edge of the dry zone the clouds had thinned to allow a watery sun to gleam through, and a few miles further east the sky was clear. The maidan was vivid with the green of young grass, cropped to a short sward by the hungry grazing of herds of scrubby cattle, which even in this season of plenty looked gaunt and half-starved. The lantana growing in great clumps lent, pestilential weed though it is, much to the beauty of the scene as it was in full flower, and the masses of bloom smothering the bushes made broad splashes of orange and pink. The tank was at its fullest. It is a rough crescent half a mile in length with a high bund all along the concave face. Two-thirds of the way along the opposite shore the regularity is broken by an arm of swampy ground where once a feeder ran in but this has long since silted up though it is still moist enough to provide luxurious wallows for pig and buffaloes. Indeed the whole tank is much smaller than it must have been at one time for even in the wettest seasons a broad strip of rough herbage lies between the belt of trees and the water. The tip of one



White-breasted Kingfisher.
(*Halcyon smyrnensis*)



Little Cormorant.
(*Phalacrocorax niger*)

Photo by Auth

horn runs right up to the jungle of the western range and here the elephants come down to drink in the hot weather when water is scarce, leaving the shore pock-marked with their enormous footprints. This end where the water is shallowest is all overgrown with beds of bulrushes but as it gets deeper these thin out and grow in smaller patches and the sheets of lotuses and other weeds which spread beyond them disappear within a few yards leaving several acres of open water.

Bird life is abundant and undisturbed except by an occasional fisherman for though the cattle water here, the paddy fields below the bund have been abandoned for many years and the nearest village is several miles away.

By far the most numerous of the waterfowl proper are the dabchicks. At least a dozen pairs have a permanent home on the lake and in July breeding is in full swing. I have found as many as six nests with eggs in one day and must have missed numbers more in the heart of the reed thickets. Most are built just inside the outer edge of the bulrush beds but occasionally they are out in full view in the middle of the open water anchored to a patch of floating weeds. They are all much the same; floating platforms of rotten waterweed about a foot in diameter. The eggs are covered as soon as the first one is laid with a heap of weed which is replaced whenever the bird leaves the nest. She is extraordinarily quick at doing this and only once have I managed to flush one before she had time to hide her eggs. A few deft movements of her bill and she dives over the edge leaving only a ring of ripples to betray her connection with what looks like a casual accumulation of rubbish. She comes up at a safe distance and tries to create a distraction by frantic splashings and flappings. During much of the day the eggs are left to themselves, the heat generated by the decaying materials of the nest being quite sufficient to keep them from getting chilled.

When incubation has started, the dabchicks are quiet birds, but earlier in the month, while courtship is going on, the lake resounds with their long trilling calls as the pairs dive and come up face to face and rub bills or chase each other half flying, half swimming across the water. Once on the wing, they fly strongly, but except at this season or when changing quarters, seldom do so. In their breeding plumage they are almost handsome, the dark chestnut of the throat and sides of the neck contrasting with the sombre brown of the rest of the upper plumage. At the best of times however their broad, rounded, almost tailless sterns give them a barge-like appearance as if built more for utility than for show or speed.

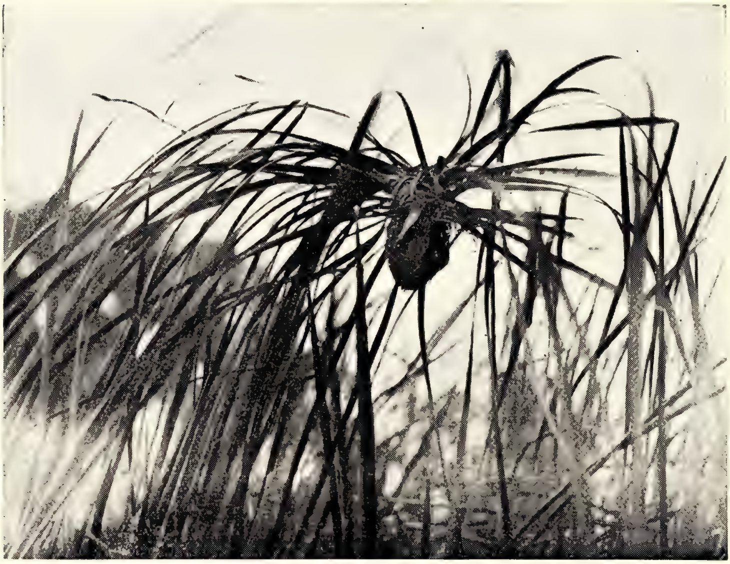
Most of the first broods are hatched off by the beginning of August. Although the normal clutch is three or four, even occasionally five, it is rare to see more than two of the little stripey chicks with the mother. The male seems to take but little interest in them. Though perfectly capable of diving when alarmed, the young at first do not feed themselves but swim round anxiously while their mother disappears under water and brings them up scraps of weed and little fishes. Within a few weeks they are full grown and independent, only their dull colouring distinguishing them from their parents who are by now busy with a second family.

Moorhens are not numerous in the rainy season though one or two pairs breed every year, building substantial nests of dead reeds among the bulrushes. They are the aristocrats of a plebeian family; quiet, well-conducted birds soberly but smartly clad in dark grey with touches of white set off by a scarlet frontlet. They are excellent swimmers, though no great divers and spend most of their time on the water paddling jerkily among the lily pads, sitting high and gracefully, stern cocked and constantly flirted to display the gleaming white of the undertail coverts. An occasional loud 'karuck' announces their presence but except during the squabbles of the courting season they are far from noisy.

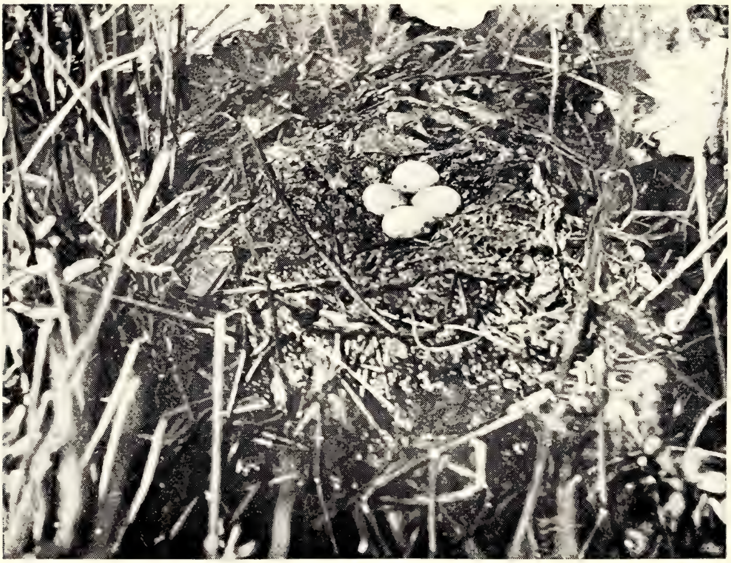
The Purple Coots on the other hand are thorough vulgarians. For all their gaudy plumage of purplish blue they have a coarse, ugly appearance and a temper to match. Each bird has his private domain, invasion being strongly resented, and the peace of the lake is constantly disturbed by their noisy brawls. They favour the reed beds or where the lilies grow thick enough to support their weight for they do not swim more than they can help and usually take wing to cross an open stretch of water, flying low and heavily with legs trailing. They love to scramble to the top of a clump of reeds, which bow and bend ominously beneath them, to bask complacently in the sunshine, quite careless of the insecurity of their perch. Their numbers vary greatly; in some years there may be twenty or thirty and in others none at all. They may be seen at all seasons but I have never found them breeding on the lake.

Common coots are only occasional winter visitors and the only other conspicuous members of the Rail family are the White-breasted Moorhens. They are inveterate skulkers and it is their voices that give them away. They only leave the sanctuary of the thickest reed beds to feed along the shore when they are quite certain that the coast is clear and at the first alarm scuttle back into cover or fly up into a thick tree, for they are more arboreal than most of their relatives and often nest at considerable heights above the ground. From their lurking places they send forth weird and uncanny bellowings and caterwaulings quite unlike any other bird notes.

A pair of these were the actors in one of the most delightful vignettes of wild life that it has been my luck to witness. I was sitting by a small waterhole in the heart of the jungle when the silence was rent by a hair-raising clamour as of some large beast in dire extremity. Presently out from under the bamboos marched a little procession, a white-breasted moorhen followed by three newly hatched chicks like balls of black swansdown, while bringing up the rear came the other parent. The old birds stalked cautiously along keenly on the alert for danger, tails stiffly cocked to show the bright chestnut underneath, a flag to guide the little ones as they scrambled valiantly through the rough grass. They were shepherded into the security of another bamboo clump, whence after loud celebration of their safe arrival, one of the parents ventured



Nest of Striated Weaver Bird, (*Ploceus manyar*) " Helmet " Stage.



Nest and eggs of Dabchick (*Podiceps ruficollis capensis*).

Photos by Author.

forth to forage on the margin of the pond to return triumphantly with a large worm in its beak.

The Bronze-winged Jacanas are very conspicuous members of the population, with their bright plumage and voices second only in power to the white-breasetd moorhens'. They must mate for life as they are always to be seen in pairs. They are admirable examples of specialised development, their toes and claws being enormously lengthened, enabling them to run swiftly and easily over the floating lily leaves, where other birds of their size would sink or flounder awkwardly. Seen thus or swimming buoyantly across the lanes of deep water they are strikingly handsome reminding one of those strange, brilliant birds to be seen on a Chinese screen. On the wing they do not show to advantage though they fly freely and well; their stumpy tails and long legs with the enormous feet trailing behind them give them a singularly unbalanced appearance. Like most of the waterfowl they are monsoon breeders and in early July are in the full ardour of courtship. The males bow and strut before their mates calling excitedly, drooping their wings and elevating and exhibiting the bright maroon feathers of the rump.

The ducks are confined to the two resident species, the Cotton Teal and the Lesser Whistling Teal. A small flock of the former are usually to be seen feeding among the floating weedbeds on the edge of the open water, keeping up a continual conversation in low, gabbling tones. Though they can dive like dabchicks when wounded they seem to be entirely surface feeders and I have never even seen them up-ending in shallow water after the fashion of domestic ducks and most of the wild, non-diving species. They must surely breed in the big trees round the tank but I have not been able to find a nest nor have I seen any young on the water and even in the rains when the drakes are in full plumage they are usually accompanied by their mates. At this time of year the drakes look very white and on a dull day show up as brilliantly as gulls at a distance where the ducks are quite invisible. They are great home-lovers and at a duckshoot are the last to leave, flying round and round low over the water long after the Grey and Whistling Teal have departed.

One or two pairs of the latter frequent the tank throughout the year but their numbers vary and I have yet to discover them breeding in the vicinity. They are much warier than the Cotton Teal and have a perennially anxious air. At the first hint of danger up go their long necks and they paddle hastily out to the middle of the open water. A couple of shots is enough to set them circling to gain height and be off to the next water. On the wing they are like no other duck with their slow unhurried wingbeats and peculiar mewing cries which they seem never to utter at other times.

In the monsoon, the Heron tribe are conspicuous by their absence but ever since I have known the tank there has been one solitary Small Cormorant whose favourite perch is a dead log sticking up in the middle of the water. There he spends hours together basking and hanging out his wings to dry in the intervals of his fishing. His right to his favourite seat is seldom disputed but on one occasion when a Snakebird paid the tank a visit he had to give way to his larger relative albeit with a very bad grace and the moment the latter departed he was back again.

Kingfishers are always in evidence and one or two pairs of the White-breasted and Common Indian Kingfishers are resident. The former obtain as much of their food on land as on the water and are fond of taking up a stance on a tall bamboo on the edge of the jungle where they can keep watch for lizards and large grasshoppers in the short grass of the dried-up margin. Pied Kingfishers often come in from the Cauvery which flows only three miles away but do not linger long. Their hunting methods are those of the trout fisherman rather than the bottom angler, for unlike most of the family they go to seek their prey instead of waiting for it to come to them. The Pied Kingfisher rivals the kestrel in mastery of the art of hovering. The little Indian kingfisher does this sometimes but with the former bird it is the normal habit. It quarters the water systematically, coming up into the wind at every few yards and hanging on rapidly moving wings, head sunk between the shoulders and bill pointing downwards as it scans the surface below. If there is anything worth a closer examination it drops a few feet vertically with a jerk as though let down on an invisible string, hovers again for a second to make sure and then turns over and plunges headlong with half-closed wings. A small object like a tadpole may be swallowed in the air but anything larger is carried off to a perch and hammered into subjection in the usual way before being devoured.

While one or two colonies of bayas breed annually in the date palms in the tree belt separating the tank from the maidan, it was only this year, 1936, that I found their near relatives, the Streaked Weavers, in residence. They are common enough on the Mysore tanks and it is probable that the poor monsoons of the last three years which have left many of these practically dry, have driven them beyond their usual beat. The bayas like to build over water if they can but their nests are always in trees and may be found well away on dry land provided there are paddy or ragi crops at hand to provide building material. The Streaked Weavers are more particular, and in this part of India at any rate, nest exclusively in reeds in standing water. Breeding starts early in July as soon as the reeds have reached their full height. The cocks are the first on the scene and at once begin building. They appear to assume breeding plumage very irregularly, many of those hard at work showing but little of the golden cap of full dress though whether this is assumed afterwards I am unable to say. The hens arrive later and only begin to take interest in the nest when it is nearing completion. Streaked Weavers' nests are much smaller than those of the baya and are not suspended on a long neck while the entrance tunnel is seldom prolonged for more than six inches. A start is made by binding twenty or thirty reeds together about a foot from their tips, and on this foundation is woven a very strongly twisted loop of grass or rather strips of reed about 1/16th of an inch in width. These are ripped off the bulrush leaves and apart from mud are the sole materials used. Work proceeds in very definite stages, there being often a pause of several days between each, for it is common to see part of the nest withered brown while the new section is still fresh and green. The second stage is to weave a dome on one side of the loop leaving the bottom open. At this point the nest resembles a helmet with chin strap, very neatly finished off with no loose ends hanging about. Weaving is temporarily suspended while a band of mud half an inch wide is plastered all along the nape of the helmet. Until the mud is dry no more is done and many nests for some reason or other get no further than this being either simply abandoned or else cut down and dropped into the water below by their dissatisfied builders. All being well however the bottom of the dome is next filled in forming an egg-shaped purse, the loop making the entrance. It is only after the eggs are laid that the tunnel is built onto the latter and is lengthened sporadically until the young hatch.

When I first saw the colony it was confined to six or seven nests in one small patch of reeds but by the end of August it had extended to almost every reedbed in the tank and there must have been thirty or forty occupied nests, never however more than half a dozen close together, and many more in an incomplete state.

An interesting feature was the association of black-headed munias with the weavers. The shores of the tank are a favourite resort of this family of small, brightly coloured finches. At one time or another I have seen all the six species which occur in this area feeding in mixed flocks in the herbage round the water's edge. The black-headed munias, in their rich chesnut, black and white are much more water-loving than the rest. A few have always nested in the bulrushes. As soon as the weavers arrived and started breeding one or two pairs of the munias took to haunting each group of nests, hopping about among their larger relatives, and even settling on the nests themselves I never saw them go inside nor had they laid eggs in any that I examined so that there seems to be no question of parasitism, but it was certain that as the weavers increased in numbers so did the munias until there were far more than I have ever seen there before. The Weavers took no notice of them whatever and apart from this consort at the nesting site the two species had little in common, the Munias feeding separately or joining flocks of other munia species. About three weeks after the first weaver's nest was completed, the munias started breeding operations on their own, making their roughly-built, untidy balls of rushes and grass low down in the reeds only a foot or so above the water, sometimes in the middle of a weaver colony but usually in a separate clump a few yards away. As with most munias the nests are lined with green grass stems, the flowering heads projecting in a frill round the entrance. It seems likely that the true weavers must have evolved their elaborate nests from something very like these primitive structures, gradually learning to split the coarse reed leaves into narrow strips more easily workable and developing the fringe round the doorway into a completely enlosed tunnel.

A visit to the tank in February or March finds a very different scene and its bird population has quite altered in character. It is at the end of the dry season before the first showers and the sun is daily increasing in strength. The maidan is sere and brown where it has not been blackened by forest fires. The jungle is a bright yellow from the dead leaves which still hang on the bamboos but most of the trees stand gaunt and bare. The only relief from the prevailing black and yellow are the brilliant splashes of scarlet where the Flame of the Forest is in flower. The belt of trees near the water however is still green and all the bird life of the neighbourhood seems concentrated in their shade. The tank has shrunk to half its size and the reeds stand up withered and dead where the water has receded beyond them. Here and there small islets and mudbanks appear, the favourite basking places of turtles and an occasional small crocodile. The waterfowl have now no family cares and lead an idle life. Times are hard for the larger beasts of the jungle but for them food is plentiful and easily obtained. The dabchicks are in their dull winter plumage but as noisy as ever. The moorhens' numbers have been increased by migrants and sometimes a small flock of Coots pay a fleeting visit. The migrant duck and teal seldom come here; they prefer the larger tanks. The heron family are in force. Pond herons by the dozen parade the water's edge, frog-hunting, almost invisible in their drab plumage until they take flight when their white wings flash out from beneath the long concealing coverts in startling fashion. The egrets on the other hand make no attempt at disguise, the dazzling purity of their dress shining from afar. Cattle egrets in small flocks wander about among the grazing buffaloes picking at the ticks and flies that infest them while the other species keep to the water, standing knee-deep, motionless except for an occasional dart of the bill as they spear a fish. In what is left of the reedbeds skulk chestnut bitterns and little green herons. They are difficult to flush and when they do take wing it is only to flop back into cover a few yards on. The reeds, too, often hold a Purple Heron, whose snakey neck is craned above the tops at the sound of approaching footsteps to be followed by a threshing of great wings as he hoists his bulk awkwardly from the ground until, free of entanglement, he tucks up his long shanks, coils his neck back on his shoulders, and wends his stately way to the far end of the lake with a croak of protest at being thus startled out of his accustomed dignity. Rarely an Open-Bill Stork comes in from the Cauvery and stalks proudly among the lesser fry or stands contemplative on one leg on the topmost branch of a dead tree.

There are other less harmless visitors. The waterfowl care little for the Brahminy Kite, the most brightly coloured of all the birds of prey, as he soars and swoops on effortless pinion overhead, for he is a coward and a scavenger though ready enough to make off with a wounded bird. The Marsh Harrier who comes down from the north for the winter meets with more respect. When his slim, long winged shape comes winging low over the reedbeds, quartering the ground with the persistency of a setter, the dabchicks dive hastily and the moorhens and cotton teal scutter into covert or freeze immobile where they sit. Worse still is the Shahin Falcon who has a hungry brood clamouring for food in their eyrie on the crags of Jainkalbetta. On her approach a deathlike silence falls on the scene and woe betide the foolish teal or coot who happens to be in the air when she appears. The tank lies within the beat of a pair of grey-headed fishing eagles but their eyrie is on another stretch of water seven or eight miles away. Serpent eagles are common in the neighbouring jungles in so far as the larger birds of prey can ever be said to be common and find the shores where numerous ratsnakes and monitor lizards come out to bask a profitable hunting ground. I have never seen these birds tackle a really large snake though doubtless they are quite capable of doing so and they are by no means too proud to make a meal off the vulgar Bullfrog when nothing better offers.

The great Wader order is well represented in the dry weather by a number of winter visitors, the only resident species being the red-wattled lapwing. One or two pairs of these handsome, long-legged plover breed round the shores of the tank and lay their first eggs about the beginning of April. While they have eggs they are very inconspicuous and leave the vicinity unobtrusively at the approach of a human being, but during most of the year they are the self-appointed watchmen of the community, being the first to spot any possible danger and warning all the other birds with their clamorous, 'Did he do it, Dick did he do it.' When they have young their anxiety and noisiness are intensified. Screaming dementedly they swoop round the head of an intruder or flutter helplessly along the ground, playing the old broken wing game and continue their demonstrations until he is well off the premises.

Pintail snipe in small numbers lie up for the day in the reedbeds, and seldom show themselves till dusk but the green Sandpipers are much bolder and more numerous. They trip daintily along the waters's edge, pausing now and then to bob on a stone, or skim lightly across an arm of the tank, flying low over the water, each sharp wing stroke followed by a long glide, displaying the white rump which is their distinguishing feature. Unlike snipe they demand actual standing water for a feeding ground, mere damp marshland is not enough for them. They wade boldly and will often swim across a channel of deep water too narrow to be worth the trouble of taking to the air. They are unsociable birds usually solitary and rarely to be seen more than two together. The smaller wood sandpipers on the other hand while they do not gather in regular well-drilled flocks as do so many of the smaller waders in winter like the company of their kind and form loose associations of twenty or thirty whose members while feeding and moving independently keep in fairly close contact.

At this time of the year bee-eaters are much in evidence and this is the only spot in Coorg where I have come across the

Blue-tailed Bee-eater. This species is common on the West Coast where it is almost a seabird, hawking far out over the estuaries and backwaters often at a considerable distance from land, but in the interior it is very local. Much more numerous is the little Common Bee-eater. Even in the rains a few may be seen round the tank but these are all immature birds. The old ones migrate during the summer months probably eastwards beyond the range of the monsoon. Both these species and sometimes the Chesnut Headed Bee-eater, distinguishable by its lack of the prolonged, needle-like central pair of tail feathers, breed on the tank shores, for, unlike the Kingfishers they do not require a vertical bank in which to burrow but are content to sink their shafts in almost level ground provided the soil is sandy and easily workable. Eggs are laid in April and a month later it is a pretty sight to see the young families perched in rows on the bamboo fronds twittering excitedly as their parents bring them the bees and dragon flies that they hunt so adroitly.

While the birds that I have mentioned are the most conspicuous frequenters of Halagote and its surroundings, they are of course not a tithe of the numbers that may be seen there especially in the dry weather when other water is scarce. At various times, practically every species that occurs in the neighbourhood may be seen there, and the probability of meeting something new and unexpected lends excitement to each visit.

REVIEWS.

MANUAL OF THE MAMMALS OF CEYLON by W. W. A. Phillips, F.Z.S., M.B.O.U., Ceylon, The Director of the Colombo Museum; Dulau & Co., London. Price Rs. 10, in England 15*s.*

All sportsmen, naturalists and zoologists interested in the Fauna of British India will welcome this admirable and much-needed volume on the Mammals of Ceylon. The collecting of the species necessary for it and the observations of their habits in the field have occupied for many years most of the leisure hours Mr. Phillips could spare from other duties. During that period dating back to the conclusion of the Great War he published from time to time many papers on interesting specimens he secured and he kept in continual touch with Messrs. Thomas, Hinton and Wroughton in the British Museum, sending them specimens for identification and description and enriching the national collection with many freshly collected skins of which it was greatly in need.

The Fauna of Ceylon has an interest all its own wrapt up in its past geological history and its former connection with Peninsular India and subsequent severance from it. Very appropriately Mr. Phillips leads off with its story in his introduction. Here too its physical features are described and these are illustrated by a coloured map showing the dry and wet zones, the central hill ranges, river systems, etc. and also the recently established Game-reserves. The main portion of the volume dealing with the characters and habits of the different kinds of the mammals is handled in the most approved style. It opens with the Monkeys and closes with the Pangolins and nearly one-third of it is taken up by the Rodents. Analytical keys presenting the most striking and obvious differences between the various groups are supplied for their ready identification and all the principal species are illustrated by excellent photographs of the living animal, sometimes depicted in its natural haunts. In addition there are well-drawn figures of heads introduced into the text to show features that escape the camera and, although cranial characters are not especially dealt with in the volume, very good drawings of the skull of the most important types have been wisely inserted. At the end of the volume there is a useful bibiliography, followed by indices of the English, Sinhalese, Tamil and scientific names of the animals.

We cordially congratulate Mr. Phillips on the general excellence of this Manual and are grateful to him for it. It will for many years be regarded as the standard work on Ceylonese Mammals.

R. I. P.

A GUIDE TO COLLECTING BUTTERFLIES OF INDIA. By Lt.-Col. H. D. Peile. Published by John Bale Sons & Danielsson, London. Price £1-5. Size 8⅝ × 5⅞ × 1½. Pages xiii-312: 25 plates (1 in colour).

The book commences with a coloured plate preceding the preface by Mr. N. D. Riley, Keeper of Entomology in the British Museum and lately Assistant Keeper of their butterflies. Then follows a brief introduction by the author: a comprehensive list of contents arranged alphabetically: a list of references and abbreviations: two pages of corrigenda: a 'Guide to Collecting Butterflies of India' (19 pages): brief descriptions of over 600 forms of butterflies (203 pages): lists of species from various localities (60 pages): a full index of specific and generic names: and the uncoloured plates (255 figures in all).

In the preface, Mr. Riley explains that the object of the author is to provide a handy volume, not aiming at completeness, but rather at an introduction to the study of such of the butterflies of India as are ordinarily met with. The book certainly fulfils its object: the guide is simple and complete and the plates are excellent. The remarks made below are not written in a spirit of adverse criticism, but with the object of suggesting improvements for embodiment in a subsequent edition, which will, it is hoped, be required soon, since a handbook more or less of this type is a real necessity for collectors in India. The price of the volume seems unduly high, when compared with that of other similar works, but this we understand is not the author's fault.

The long list of corrigenda is unfortunate and, it is feared, not complete: for instance '*Oclodes*' on page 222 should be '*Ochlodes*' and it is to be noted that this name is not included in the index.

The excellent 'Guide' calls for very few remarks. On page 1, the distinguishing features of the various Families would have been better arranged in the form of a key. The statement on page 4 that common ancestry is an important factor in the case of Mullerian mimicry is contradictory: probably the author had in mind a Mullerian association of closely allied species. On page 6, something might have been said regarding the symbiosis between ants and Lycaenid larvae. Instances should have been given in support of the assertions on page 9 that androconial scales vary with the season and that some Lycaenids are tailed at one season and not in another: none are known to the reviewer. The statement on page 9 regarding tibial spurs is incorrect, though correct on page 20. In speaking of tails on page 12, mention might have been made of the apparent protection they afford to Lycaenids, where they emanate from eye-like ocelli, inducing an enemy to regard the posterior end of a butterfly as the insect's head. Migration finds no place in the 'Guide'.

The selection of butterflies for inclusion in the main portion of the book was doubtless a difficult matter, but the results are decidedly 'patchy'. Of the 381 species dealt with the majority are such as were personally known to the author, who collected principally at Mussoorie, Peshawar, Bannu, Miranshah and Fatehgarh. Consequently for the plains of N. India. the West Himalayan hill stations and the N.-W. Frontier Province most of the species that occur have found a place and the author's observations regarding them are of interest. Odd species from Ceylon, S. India and the higher Himalayas are included, but Darjiling and Assam have been left out in the cold, and the book will be of very little use to collectors in these places. Rare species such as *Everes moorei, Euchloë belemia, Vanessa atalanta* and *Argynnis clara* have been included, while such common species as *Papilio crino, Cepora nadina, Nacaduba dubiosa, Arhopala centaurus, Udaspes folus,* the *Notocryptas* and *Pelopidas guttatus* and *bevani* have been omitted. *Mycalesis neavisala* (page 84) is not a species. On page 47 a new name, *tochica,* has been coined for the Tochi form of *Pieris rapae,* but the description is very scanty.

The genus *Papilio* has been divided into subgenera, a system, which, if required at all, should have been adopted elsewhere. The author has made an effort to bring the nomenclature up to date, but does not emphasise the changes sufficiently: for instance collectors in India will have a shock when they realise that such an old friend as *Belenois mesentina* is now acled *Glycestha aurota.* Opinions on specific identity, such as are expressed on pages 65-69 and 171 regarding the species of *Colias* and *Lycaenopsis kollari* are out of place in a work of this nature.

The descriptions for the most part have been given under the title of 'Key': most of them have been taken from keys arranged as keys, but when substituted for descriptions they are apt to be confusing. For instance the beginner will find it difficult to distinguish the species of *Lampides* (page 184): *bochus* and *celeno* are keyed as having the fourth transverse band from the base ending on vein 3, but the corresponding position is not given for *cleodus* and *alecto*, while in the case of the latter species the key only deals with the difference between the subspecies. For *Lampides* the plates will help towards the solution, but for the next genus, *Nacaduba,* there are no figures and it is feared that the beginner will be quite helpless.

For the next edition it is suggested that subspecies should be omitted altogether and more species included. At least one species of each genus should be figured and the descriptions of the species confined to divergences from the figures. In this connection it may be noted that three species, looking almost exactly alike, of the genus *Aulocera,* are figured, while there are no figures at all of *Prioneris.*

The local lists will prove useful. Rhe. Philippe's lists for Lahore and Simla might have found a place, while the lists for Cachar, Manipur, the Naga Hills, Chin Hills and Ceylon, might well have been omitted as the majority of species therefrom are not dealt with in the book.

There is no index for trivial names and the inclusion in the index of names from local lists seems unnecessary.

The plates have been drawn by the author and are excellent for the purpose. Figure 85 represents *loha* and not *padma*. Figure 107 looks more like *zeroca* than *selenophora*. Figure 171 of *lohita* more nearly resembles *syama*. Figure 226 of *maha* lacks the diagnostic spot in the forewing cell. Figure 200 *huegelii* is repeated as figure 213. Figure 247 probably represents *subochracea,* and not *mathias,* which has a dark brand.

To sum up, the 'Guide' is excellent and the plates are very good: the descriptive portion of the work would have been better had the included species been more carefully selected.

W. H. E.

March 4, 1937.

A BEAST BOOK FOR THE POCKET. By Edmund Sandars. Pp. 378. London: *Oxford University Press*; 1937. Price 7*s*. 6*d*.

This excellent book deals with the Mammals, Reptiles, and Amphibians of the British Isles.

'After preliminary articles on each Class, Order, or other group the plan of the book is to treat each species separately, giving: (1) the English name; (2) the scientific name; (3) the habitat; (4) a general description of the visible form, indicating the characters which distinguish it from other species; (5) a general idea of the teeth; (6) of the limbs, and (7) of any notable peculiarity of internal structure; (8) its life history, the young, their number and development; (9) its yearly life as affected by the seasons; (10) its daily life, including manners and behaviour; (11) food; (12) gait, on land, in air or water, and (13) its voice. A heading "Varieties" is added for the record of albinism or similar oddities and for such local races as have been distinguished as sub-species.'

'In the case of a domestic animal the heading "Habit" is replaced by a reference to its "origin", so far as anything is known, and to its "uses" to Man,: while the heading "varieties" covers the "breeds".'

The book contains some 215 illustrations distributed on 96 coloured plates, and nearly 200 line drawings interspersed in the text. The latter are surprisingly good; and the small maps showing the distribution and the numerical density of each species are particularly welcome.

The notes on the teeth and the gait are excellent; and many will delight in the sketches exhibiting the 'paces' of animals, their tracks and their footprints.

For the scientific names the author follows the so-called Trinomial System of nomenclature; but by an ingenious device of squaring and cubing he avoids repeating the same word twice or thrice. Thus *Meles*^{3} stands for *Meles meles meles, Mustela putorius*^{2} for *Mustela putorius putorius,* and *Vulpes*^{2} *crucigera* for *Vulpes vulpes crucigera.*

The only jarring sound is that of the Preface, written in a tone so apologetic as to become irritating. Quoth the author: 'My work has been to collect, compress and as the French say, to "vulgarize",' . . . Why drag the French in when the Oxford Dictionary has: ***Vulgarize*** *2. trans.* To make common or popular; to reduce to the level of something usual or ordinary, 1709, and ***Popularize*** c. To present (a technical subject, etc.) in a popular form, 1836.

J. F. C.

NOTE

ON THE BURMA WILD LIFE PROTECTION ACT.

During the August Session of the Burma Legislative Council the Burma Wild Life Protection Act of 1936 was, after consideration, referred to a Select Committee, and after some revision, passed without opposition. The Act extends to the whole of Burma. Under Section 28 the Government has power to draw up rules under the Act.

Sanctuaries

Its prescriptions allow of the declaration as a sanctuary of any land which is at the disposal of Government, and, subject to the consent of the owner and to such conditions as may be determined by mutual agreement, any land which is private property. Within a sanctuary no person is permitted—

(*a*) to hunt without the special permission of the Local Government which is only granted for scientific purposes, or to preserve the balance of animals, or

(*b*) to drive, stampede or wilfully disturb any animal. (Sections 3 and 4.)

Reserved Forests

Section 5 lays down that no person shall hunt, drive, stampede or wilfully disturb any animal or remove any animal or part or product thereof from a reserved forest except under a license.

Other land

Outside sanctuaries and reserved forests certain animals are declared:—

(*a*) Completely protected—rhinoceros, tapir, argus pheasant and masked finfoot,

(*b*) Protected—elephants, bison, *saing*, *thamin*, serow and goral, or

(*c*) Protected during certain close seasons.

(*a*) *Completely protected animals* can only be hunted under conditions of a special license issued by the Local Government for scientific purposes and no person may possess, sell or buy them alive or dead, or any part or product of them with the following exception. Any physician or druggist may possess or sell, or any person may possess for private medical purposes rhinoceros blood or any preparation thereof. This exception is a blot on an otherwise excellent Act, but it was essential for the reason that so many people in Burma have an implicit faith in the efficacy of rhinoceros blood for medical purposes. Had this exception been omitted, the Bill would probably not have been passed. In the past, although possession and sale of rhinoceros blood has been illegal, it has rarely been possible to prosecute the small country physician or the private person who may have possessed small quantities for medical purposes. It is doubtful whether much, if any, of the product known as rhinoceros blood is genuine. The prohibition against hunting and killing, or possessing or selling of parts and products of rhinoceros is, with this exception, absolute and it is hoped that the new Act will render poaching more difficult than it has been up to date, especially as it will probably be applied, at any rate so far as rhinoceros are concerned, to Backward Tracts which were outside the area to which the provisions of the old Game Laws applied.

(*b*) *Protected animals* may only be hunted under license. Without a license it is illegal knowingly to possess or sell or buy such animals alive or dead, or their parts or products. An important addition to the list of protected animals as compared with the previous Game Rules is *thamin,* the brow-antlered deer, the numbers of which have been very seriously depleted in recent years.

(*c*) *Animals protected by close seasons.* Hog-deer, sambhur and barking deer are protected from the 15th June to the 30th September and all game birds from the 15th March to the 30th September. The possession or sale of such during respective close seasons is prohibited.

An entirely new section prohibits the capture, possession, purchase or sale of live snipe, wild duck, teal and wild geese during the whole year. This is an important section designed to prevent the cruelty entailed by keeping these birds alive. No attempt has been made to protect in a similar manner partridges, quail and jungle fowl as cruelty can less well be substantiated.

Power to add any other animal by notification to the list of animals protected in any of the above categories has been vested in Government.

Section 10 prohibits hunting, by use of poison, pitfalls, machans, hides, pits, or artificial light for animals other than carnivora. It prohibits the shooting of animals other than carnivora from the back of an elephant or any kind of wheeled vehicle or aircraft, and the use of elephant or wheeled vehicle or aircraft to drive, stampede or disturb any animals other than carnivora. Hunting within 200 yards of an inhabited Buddhist monastery or religious edifice for which trustees have been appointed, the use of explosives for fishing in reserved forests and hunting with dogs except in the case of carnivora, hares and birds, are likewise forbidden.

Section 11 regulates the export and import of animals.

The term 'animal' includes all birds, mammals and reptiles other than snakes found in a wild state in Burma, and in reserved forests, fish. Outside reserved forests fish come under the provisions of the Burma Fisheries Act for which reason it was not possible to regulate fishing outside reserved forests under the Wild Life Protection Act.

The Act provides for penalties and gives powers to Forest Officers and Game Wardens to compound offences. Various other powers are given to Police Officers, Forest Officers and Game Wardens under the Act. Exemption is granted to the trustees of the Victoria Memorial Park, Rangoon (Zoological Gardens) for the acquisition, possession, sale, exchange, import and export of any animals. The keeping in captivity of animals and birds other than completely protected or protected animals for purposes of display, educational purposes or in public parks and gardens is permitted.

The above précis of the Burma Wild Life Protection Act of 1936 may be of interest outside Burma. It has been generally approved in Burma and met very little opposition. The one drawback, to the Act, is that it permits possession and sale of rhinoceros blood in certain circumstances, but the fact that such a comprehensive Act has been passed through a modern Legislative Council is a considerable achievement and a noteworthy example of the attitude of the general public in Burma and more especially of the politicians, to wild life protection.

AN APPEAL

Wanted Stag Beetles.

I am engaged in preparing a volume upon the Stag-beetles (Lucanidae) for the Fauna of British India series and should be very glad to get into communication with any collectors who might be able to assist. The large males of several Indian species are well known, but there are numerous other kinds which are very inadequately known and females are difficult to identify. I shall be happy to name and return, if desired, any specimens sent to me. Very careful packing is necessary when sending specimens by post.

GILBERT J. ARROW,
Author of several volumes
in the Fauna of British India Series.

MISCELLANEOUS NOTES.

I.—ASSOCIATION BETWEEN A LEOPARD AND A TIGRESS.

While tigers and leopards may sometimes be turned out of a somewhat small patch of cover, no such association as that instanced in Iftikhar Ali Khan's interesting note has been previously recorded. There seems to be no sufficient reason why there should not be hybrids between tiger and leopard. Mr. F. C. Hicks, in his book *Forty Years Among the Wild Animals of India*, states that he shot 'an undoubted hybrid between a tiger and a panther,' described as follows:—'Its head and neck were purely those of a panther, but with a body, shoulders, and neck-ruff unmistakably of a tiger, the black stripes being broad and long, though somewhat blurred and breaking off here and there into blurred rosettes, the stripes of the tiger being most predominant on the body.' The animal was an old male, measuring a little over eight feet in length. Unfortunately this unique specimen disappeared in the confusion and illness caused by Mr. Hicks being mauled by a wild beast.

In *The Field* of 18th January, 1908, the skin of an abnormally-marked leopard, which may have been such a hybrid, is thus described:—'Although the markings present some approximation to the jaguar type, the head and back are ornamented by an altogether peculiar kind of meshed network of broad buff lines, the first mesh which occupies the head being much larger than all the others.' The markings are stated to bear no approximation to the tiger type, and it is remarked that tigers are seldom found in the district of the Deccan from which this animal came. But tigers have lines, and meshed markings on the head. In hybrids I believe the more primitive type is biologically predominant, so a hybrid tiger-leopard would perhaps be more approximate to the leopard. The fact that tigers are seldom found in the district favours the hybrid theory, for the two species would be more likely to mate where one is seldom found, and where it could find no mate of its own species.

Charlton Kings,
Glos. England.
January 29, 1936.

R. G. BURTON,
Brigadier-General.

II.—TWO WARY TIGERS AND TWO OTHERS.

Receiving news of a kill late one afternoon I hastily had a machan put up over the victim, a well-conditioned cow. The tiger had made a good meal and the cow's head had been chewed off. Although the ground was too hard for tracks to be seen there was every indication that the kill was that of a tiger. When at about 7 p.m. a panther rolled up I thought that the kill was possibly the work of two panthers and laid the feline out. Four cases have occurred in this district of two panthers at a time being bagged on a kill, and I now waited for its mate to turn up. Sure enough I soon heard an animal approaching but on its arrival near my tree I was convinced by the heavy tread that it was a tiger. The tiger, as it turned out to be, made the usual detour around and then approached the kill on the side the panther was lying dead. It was now almost dark, but I could tell exactly what was happening: the tiger stopped, evidently spotting the intruder, hesitated but for a moment, then landed on the panther with a mighty leap, and as the latter showed no signs of life started to drag; and here I made my mistake. I should have allowed the tiger to make a meal of the panther, if that was its intention, and then to return to its original kill. The tiger dragged the panther through long grass and for a moment I distinctly saw a whitish patch appear, which I took to be the tiger's chest, and fired. The tiger bounded away with a roar and did not return again to the kill. On the following morning I found traces of blood and spent three days tracking the tiger with no result.

A fortnight later another kill occurred and on arriving at the spot the first thing I noticed was the head of the kill lying to one side, and all around tracks of a big tiger. My Shikari, strictly against orders, had moved the kill slightly to present a better target to the machan. The tiger turned up at about 7 p.m. and, evidently realising the kill had been moved, for one hour stood suspiciously to one side and then slowly walked away and never returned.

A week later another kill occurred, here again the head had been severed and the tracks of obviously the same tiger were close by. The kill was in very thick cover and it was necessary to cut away a few branches to enable the kill to be seen from the machan. This too made the tiger, which arrived on the scene just after dark, suspicious, and it abandoned the kill as before. These three kills were on the hills.

Subsequently frequent kills occurred on the plateau off the hills and in every case the head of the kill was bitten off, earning for the tiger by now the sobriquet 'head biter'. Never would the tiger return to its kill the second night, and the killing went on freely for nearly two years. I once thought I had him: I was sitting up over a kill with its head *half* chewed off. The weather was wretched and at midnight deciding the tiger would, as usual, not return I lay down on the machan. At 5 o'clock in the morning I was awakened by a slight noise on the kill and rose to a sitting position very slowly. I could hear something eating very quietly, and very unlike the noise made by a tiger on its kill. It was a tiger however, an enormous brute, and made the welkin ring with his roars on receiving my shot. To my surprise I found he was tailless. He was duly carried to the road three miles away, tied to the luggage rack of my car, and the huge tailless creature caused great excitement amongst my employees. If he had possessed a tail he would have measured quite 10 ft.

Soon after this other kills occurred down below with their heads severed and I realised that the head-biter had not been brought to book after all.

Three months later two cows were killed near my cattle kraals and there was every indication that the victims were those of the head-biter. The manager of the next Estate and I sat up with the same fruitless result. On the following afternoon I received news that a buffalo had been killed out in the open on a hill above the cattle sheds and reached the spot in quick time; I was pleased to see that the tiger had neither eaten nor dragged the kill; here was a chance anyhow. I lay down on a rock not far from the kill with a roll of bedding in front of me as I was determined to spend the night there if necessary. At 6 p.m. just as the light was getting poor the tiger walked out of a large shola and strode rapidly across the open maidan; I fired as it reached its prey. The tiger leapt into the air with a roar and crashed out of sight into long grass and then into a small shola where I heard it struggling, followed by silence. As it was dark very soon after this, nothing further could be done. We found it dead next morning, and no heads have been bitten off tiger kills since! It measured 9½ ft.

A month later a large tiger started killing on the hills, and by not returning to his kills on the second night he showed himself to be not less wary than the head-biter. Fruitless nights were spent on machans and I felt there was not much chance of bagging the animal, over a kill at any rate.

News came in early one morning that a cow that had strayed from its pen had been killed. As the kill had evidently occurred just before daylight, and the tiger had eaten very little, this seemed more promising. I was in the machan at 4 p.m. and at 6 o'clock I heard the tiger nearby. He was the embodiment of caution and having taken one hour to make up his mind to approach the kill and then did so very slowly and cautiously. Instead of feeding, the tiger lay down a yard or two to one side in thick *Strobilanthes*, and for nearly another hour complete silence reigned while he listened intently for the slightest unusual sound. Partially satisfied he then got up, walked round the kill through the *Strobilanthes* two or three times growling softly, and finally commenced to feed. Immediately my torch shone on the kill the tiger was away in a bound, and this was repeated half an hour later when he made another attempt to feed. The tiger then went away giving tongue angrily and I did not expect to see him again. However at 5·30 in the morning the tiger returned probably very hungry. The tactics he now adopted were to rush the kill, seize a mouthful, and jump to one side into the *Strobilanthes* where he could eat in safety. This exasperating state of affairs continued till 6 a.m. when it was still dark inside the dense evergreen shola. It was a problem whether to await the coming of daylight or to take the risk of using the torch as the tiger approached the kill for one of his snatch and grabs, and I decided on the latter course as it was uncertain that he would carry on the game until there was light enough to shoot. Awaiting my chance I switched the torch on the tiger as he was just about to tear a large hunk of meat from the kill and fired, badly wounding him; but before I could fire my second barrel he got away crashing up against my tree in his rush. A few moments later I heard the tiger gasping in the jungle to my right and then silence.

When it was quite light I called up my men and very quietly followed the tracks (there was very little blood) through the *Strobilanthes* which showed clearly the tiger's line of retreat. The *Strobilanthes* got thicker as we went slowly forward until we eventually came to a rock where, sensing that we were close to the tiger, I put my men up trees. I was sure I had heard something though what it was I could not tell. After ten minutes of intense silence we distinctly heard him breathing heavily in a hollow to our front. The tiger located, I could now form a plan of action : returning on our tracks with my men I sent for a herd of cattle from a nearby pen. The Sholagas were instructed to drive the cattle to the edge of the hollow where the tiger lay, below where we had stopped, to suddenly give vent to almighty yells and shouts to stampede the cattle into the hollow and to shin up trees immediately. I was to cut off the tiger's retreat (outside the shola) in the open grassland, beyond where he was lying up. The plan worked well: I heard the cattle being driven into the shola, then a frightful uproar, and the cattle crashed down into the hollow snorting and bellowing as they scented the tiger or rather where he had been. From where I was sitting on a rock the ground sloped gently down towards the shola, and then steeply to the shola's edge. Suddenly I heard langurs, sitting on trees in the jungle behind me, giving vent to the particular call they reserve for felines, and looking round the thought struck me that I was too late, that the tiger had crossed over the grass maidan into the jungle beyond before my arrival. I did not realise that the langurs perched on tree tops, could see the tiger walk out of the shola I was covering, before coming into my view, until a growl brought me round again in quick time to find that he had advanced to within a few yards of me: I slew him in the nick of time, a large brute, 9 ft. 6 in. My first shot had wounded the tiger in the stomach, and he would have been a nasty customer to deal with had I not killed him when I did.

In September last year my brother-in-law wounded a tiger over a kill he and I were sitting over. The machan was placed at an awkward angle, and it was a long shot. Early on the following morning we were on the tracks and soon realised that we were to deal with a tiger with a smashed foreleg. The tracks led out of a deep ravine, in which the kill had occurred, up on to a stony flat sparsely dotted with patches of thick scrub, and here it was most difficult to pick up the tracks with any certainty as the ground was dry and hard. Eventually an excellent tracker we had with us, discovered that the tiger had passed through a small patch of scrub in which he had lain down, and from here on the tiger appeared to have rested in nearly every bit of cover in his path. In the meantime a herd of cattle that had been sent for arrived on the scene and the tracking continued with the herd spread out ahead. The cattle had just reached a largish area of dense cover lying in a hollow when they were stampeded in all directions by a terrific roar. Here the trailing of a wounded feline with the aid of cattle was put to good purpose: the tiger was located, and it was no longer a case of odds on the tiger if he charged. Advancing cautiously we found he had moved out of the cover and over a rise into another hollow where he was undoubtedly lying up. Having placed ourselves in suitable positions our trackers threw a stone into the cover, this was greeted with a long-drawn snarl; and at the next stone the tiger charged giving vent to a series of coughing roars. Although handicapped with a broken foreleg and the rising ground he came at a great pace and was within a yard or two of us as he broke cover. Receiving our simultaneous shots he rolled over but was up at once and made a gallant attempt to get at us again; but our second barrels did their work and the tiger crashed headlong down the slope and lay dead, a fine massive brute, 9 ft. in length.

HONNAMETTI,
ATTIKAN P.O., *via* MYSORE.
November 28, 1936.

R. C. MORRIS.

III.—STRANGE BEHAVIOUR OF A TIGRESS.

The following account of a 'leopard' on a neighbouring tea garden may interest your readers. The animal first appeared about Christmas time, and for two months stayed in the vicinity, killing at least five calves and one pig, all in houses. On one occasion after killing a calf in a house and taking it out, the marauder was chased away, but returned at 2 a.m. and was fired at and missed. Yet it returned again to take away the kill before daylight.

During a space of ten days this animal appeared four nights in the manager's bungalow compound, and endeavoured to break into the hen-house. Once it appeared at the steps of the back verandah. One night while in the compound two shots were fired at it, both missed.

Reports of those who had seen the animal agreed that it was a leopard with a tiger's face. Thereupon my friend devised a portable all-iron goat trap to catch this extraordinary creature Almost immediately the animal was caught on March 9th and turned out to be a tigress, 8 ft. 3 in., nearly dry of milk. Cubs were supposed to have been heard of in the district.

She was in an emaciated condition, and covered with ticks, some the size of a 3-penny piece. Is it not unusual for a tigress, even though starving and with cubs, to take to the habits of a house-invading leopard? Presuming she had not the strength to kill a buffalo or large bullock, there were thousands of cows and calves throughout the whole district on the fringes of the jungle—an easy prey to the cattle-lifting tiger.

BADLIPAR P.O., ASSAM.
April 11, 1937.

E. P. GEE.

IV.—MEASUREMENTS OF TIGERS IN THE NAGA HILLS, ASSAM.

Since 1927, I have kept a careful record of the lengths between pegs of tigers shot on this and on eleven other neighbouring Estates. Total 59—Tigers 27, Tigresses 32. The average length of 18 full grown males is 8 ft., 7 in., and of 25 females 7 ft. 9 in., only one tiger exceeded 9 ft., this taped 9 ft. 6 in., and was quite exceptional.

I have only three accurately recorded weights. Two large males weighed 330 and 344 lbs. respectively, and a small tigress 218 lbs. It would appear that the tigers of this particular district, are definitely smaller animals than those recorded from other parts of India. I would add that the majority are game killers inhabiting the dense evergreen jungles at the foot of the Naga Hills, which tends to support the views of the old Shikaris, that the game killer is a smaller more active beast.

Towkok Tea Estate,
Sonari P.O.,
Sibsagor, Assam.
March 18, 1937.

G. H. L. MARSHALL.

[Mr. Marshall's measurements of Tigers shot in the vicinity of Naga Hills are of much interest and suggest the need of similar data from different parts of India. We have Sir John Hewett's record of Tigers shot by him (Rowland Wards' Records, 1928 edn.) in Garhwal and Naini Tal. Eight males ranged between 10 ft. ½ in. to 10 ft. 5½ in. While 7 females were between 9 ft. to 9 ft. 3 in. Compared with the measurements given by Mr. Marshall it would appear that tigers in Garhwal are much larger than those from the Naga Hills. Unfortunately Sir John's records from Naini Tal and Garhwal all relate to large animals and we do not know whether any smaller animals were shot by him in this area and have therefore no means of arriving at conclusion regarding the average size of tigers in Garhwal. It is generally assumed that tigers from South India are on the average smaller than those from Central and Northern India. Average measurements arrived at from records such as Mr. Marshall has kept, if obtained from different provinces, will alone help us to arrive at definite conclusions regarding the size attained by tigers in different parts of the country.—Eds.].

V.—MANGE ON WILD DOGS.

I recently shot two wild dogs, a male and a bitch, which were as badly affected with mange as I have seen on any pie dog. The dogs were feeding ravenously on a three-days-old tiger kill, and seemed to be quite active.

With the exception of the head, which was blotchy, and the ridge of the back the dogs were almost devoid of hair including the tail. The short pig-like tail, free of the brush or hair, and the pink and mangy fleshy appearance of the flanks and stomach gave the dogs quite a revolting appearance.

HONNAMETTI ESTATE,
ATTIKAN P.O., *Via* MYSORE,
February 6, 1937.

R. C. MORRIS.

VI.—NOTES ON HARDWICKE'S HEDGEHOG (*HEMIECHINUS COLLARIS* GRAY & HARDW.).

During a visit to the Great Rann of Kutch, in October 1935, I collected about ten living specimens of *Hemiechinus collaris* at Kawra, Pachum Island. This hedgehog is quite plentiful around the village.

Most of the specimens, I discovered later, were pregnant females. From Kawra to Bhuj, a distance of some fifty miles over roughish tracks, the hedgehogs travelled in a sac on the floor of the car. On arrival at Bhuj they were transferred to a packing case pending my departure for Bombay. To my surprise, the next morning after our arrival at Bhuj, I discovered that the females had discharged their respective fœtuses. No two of the fœtuses appeared to be of the same term. The only reason I could discover for these wholesale abortions was probably the car drive!

An interesting point emerges from this incident. According to Dobson (*vide F.B.I.*, Mammalia, p. 214) the number of young at a birth never exceeds four. But what is the 'normal' number? From the premature births referred to above and the disparity of age observed in the fœtuses, it would appear that only one at a birth is the 'normal'! If there were more than one, surely there would have been some fœtuses of the same age, and again the number of fœtuses would have exceeded the number of hedgehogs in the box! This was not the case.

Hedgehogs appear to be most numerous in the neighbourhood of villages. The reason for this probably being the nature of their diet. They live on almost any refuse. Small mammals, birds, batrachians and reptiles also form part of the menu. In captivity they drink milk readily. These animals soon become quite tame even when caught old. They fight much when several are kept in the same cage. The usual point of attack is the legs and sometimes the face. A hedgehog will catch the leg of an opponent and immediately curl up and the leg is usually bitten off—the antagonist is killed eventually piecemeal. Under stress of excitement or pain the call is very kitten-like.

BOMBAY NATURAL HISTORY SOCIETY,
BOMBAY.
October 24, 1936.

C. McCANN.

VII.—SOLITARY BULL BISON (*BIBOS GAURUS* H. SM.).

I have more than once expressed the opinion that old solitary bull bisons have not necessarily been turned out of the head by younger bulls, a widely-held belief. This has also received support in connection with the African buffalo. My theory is that in the majority of cases the bull arrives at an age when he leaves the herd of his own accord; and in his solitary life he develops in strength. When he wishes to rejoin a herd temporarily during the breeding season he does so, and has no difficulty whatsoever in becoming the master of the herd for 12-14 hours, before retiring from the proximity of the herd daily. In other words he joins the herd at about 5 or 6 p.m., remains till 7 or 8 a.m. in the morning, and then walks away to a secluded place.

A case in point: a herd of 40 bisons near here; a fine old solitary, with horns worn down to about half their original length, an immense bull, takes possession of the herd daily in the manner indicated during main breeding season. The other herd bulls fight with each other, but leave the old fellow severely alone; he is obviously more powerful than they are. The breeding season over, the solitary leaves the herd for another nine or ten months.

HONNAMETTI ESTATE,
ATTIKAN P.O., *Via* MYSORE. R. C. MORRIS.
January 6, 1937.

VIII.—WHISTLING SOUND MADE BY BISON (*BIBOS GAURUS* H. SM.).

On page 151 of his book, *Wild Animals in Central India*, Dunbar Brander refers to the whistling of bisons as one of the most peculiar sounds made by them and associates it with breeding.

While shooting in the Cochin State Forests in the early part of December 1935 this whistling was heard by me on two different occasions. On hearing it the first time I thought it was made by some big bird and the tracker on being asked said it was made by a bull bison.

Immediately following on the whistling sound, bellowing and crashing in the undergrowth were heard and on going in the direction of the sound, we realised that two bisons were fighting. The wind being unfavourable the fight was interrupted, one bull being seen as he turned round to look at us, while the rest could be heard crashing away into the jungle.

The second occasion on which whistling was heard was at about seven in the morning, the sound being repeated two or three times. I was unable to come up with this herd.

I feel sure that this whistling sound has to do with the breeding season as most of the bull bison have joined the herds by November in these forests. I saw a bison bull jump a cow early in November 1934 in the same locality.

TANJORE, C. H. BIDDULPH.
February 9, 1937.

IX.—COLOURATION OF THE BISON'S SNOUT AND TONGUE.

With reference to Mr. C. H. Biddulph's note, in *Journal*, vol. xxxix, p. 165, on variation in colouration of the exposed part of two bull bisons' snout and tongue: it is not at all uncommon to see the snout of mature bulls pinkish in colour: though rarely so in the case of cows. One bull, a solitary, I recollect seeing some years ago, had a snout that was almost red! The colour of the tongue varies from white, greyish-white, to grey.

HONNAMETTI ESTATE,
ATTIKAN P.O., *Via* MYSORE. R. C. MORRIS.
S. India
February 4, 1937.

X.—REPLACEMENT OF HORNS IN NILGAI.

I was very interested indeed in Mr. Hall's notes on 'The Growth of Horns in Nilghai'.

So far I have shot well over a hundred of these ungainly antelopes. As far as my observations go they are as follows.

I don't think the Nilghai sheds its horns in such a way as deer do, nor do I think the horn is shed revealing new ones of small size at the base. At least they do not do it on our side of the world. In all I have seen six or seven Nilghai shed their horns. All these had average size horns. But it was the outer covering that was peeling off the horn and the inside horn was of the same length as the one that was chipping off in pieces. Sometimes the outer covering takes quite a time to come off. First the outer horn cracks along the length of the horn and then due to friction made by the Nilghai rubbing its head against a tree the horn starts falling in small bits revealing a beautiful shining black horn inside.

So far I have not seen such shedding of horns in small males. It is always the big full-grown bull that sheds. In my opinion they must be shedding at very long intervals.

Any way I should very much like to know more about it.

RANJIT VILAS PALACE,
WANKANER, CHANDRABHANUSINHJI
April 5, 1937.

[As indicated in the Editor's comment to Mr. Hall's note (*J.B.N.H.S.*, vol. xxxix, No. 1, p. 172), horn replacement, when it takes place among Bovines is not effected by the shedding of the horns, but by a process of exfoliation, the older horn pealing off gradually till the fully developed new horn underneath is bared. The above note confirms the view that such horn replacement takes place in the Nilgai. An interesting point is that the replacement in nilgai is effected not during adolescence but in maturity.—Eds.].

XI.—AN ELEPHANT 170 YEARS OLD.

(*From The Times, London*).

In connexion with the longevity of animals, concerning which some correspondence appeared in *The Times* a few weeks ago, my attention has been drawn by Dr. P. E. Pieris, Trade Commissioner for Ceylon, to a record of a remarkably long-lived Asiatic elephant. In a translation of Joao Ribeiro's 'Ceilao' by Dr. Pieris (third edition, 1925) mention is made of a famous elephant, Ortela by name, which was probably a fully adult animal prior to the siege of Colombo in 1656, since we are told that the animal at this time had 'offspring and descendants.' The same specimen is referred to by Emerson Tennent in his 'Natural History of Ceylon' (1861) as still being alive when the British flag was hoisted in Colombo in 1796. This elephant is reported by Tennent to have been found in the stables by the Dutch on the expulsion of the Portuguese in 1656 and served under them during the entire period of their occupation, more than 140 years. During the siege of Colombo, Ortela was the only elephant out of 15 animals which was not eaten by the defenders, and it is said that it did much useful work in bringing up trees to repair the breaches in the city walls.

From the evidence available it would appear that an elephant's age is determined by its teeth, and that as soon as the last molar tooth is in position on each side of the jaws a period is set to the animal's existence. Elephants' grinders succeed each other by horizontal, not vertical succession, moving forward in the arc of a circle and pushing the old teeth out in front. There are six cheek teeth developed on each side of both jaws, three being the so-called 'milk molars' and three the permanent molars. Not more than one, or parts of two or sometimes three teeth, are in wear at one and the same time, the elephant being very economical regarding the use of its teeth. Each successive tooth with the exception of the fourth, or first permanent molar, is more complex than its predecessor, the number of ridges increasing according to the following formula: 4, 8, 12, 12, 16, 25; this formula applies only to the Asiatic elephant, the African beast having its teeth arranged on a more simple plan, the ridges not being so numerous (3, 6, 7, 7, 8, 10-12). Doubtless when the animal's diet is free of grit or sand the teeth will last longer than when these impurities are present, but under the most advantageous circumstances an elephant living for 170 years or so is a fact which is very astonishing.

British Museum (Natural History),
Cromwell Road.
April 21, 1937.

GUY DOLLMAN.

XII.—WHALE-BONE WHALE STRANDED ON THE TRAVANCORE COAST.

A whale was stranded on the sea-side at Pulluvila about 12 miles south of Trivandrum on the morning of 4th February 1937. The animal had been dead a few days; for when I inspected it on the following day the flesh was in an advanced state of disintegration, and some of the bones, blubber and the guts were exposed. It measured 45 ft. in length and the girth at the fore limbs (fins) has been estimated at 10 ft. Other measurements evidently could not be obtained. The baleen plates had decayed and the jaw bones were exposed. From what could be seen of the specimen, I am of opinion that it belongs to the Balænoptera sp. probably *Balænoptera indica*. While preparing the skeleton for acquisition to the local Museum a few bones of the left fin have been found to be shattered.

Instances of whales set ashore by the sea have been rare on the Travancore coast. In February 1902 a False Killer (*Pseudorca crassidens*) was stranded at Trivandrum and a big Baleen Whale was reported to be found at Rajakkamangalam also on the South Travancore Coast in about January 1904. None else have recently been recorded. It is noteworthy that in all these instances the time has been between January and March.

Government Museum,
Trivandrum, Travancore State.
February 15, 1937.

R. V. PODUVAL,
Officer-in-Charge.

XIII.—UNCLEAN ANIMALS.

Hares once given the opportunity, without doubt are filthy feeders. The ordinary jungle animal living remote from villages is quite fit for human consumption. The same applies to the wild pig: there is little that is offensive in his diet and flesh and I have often eaten him.

But when human excreta is readily available it is their 'habit' to eat it; just as rabbits make a 'habit' of dealing with corpses when similarly placed.

During the famines in the Central Provinces, a temporary population of some 5 to 10,000 persons would be collected on a construction camp—say the bund of a tank. This population lived in the adjoining fields. Hares in numbers used to collect round these camps and apart from often having seen them eating excreta, their breath testified in an 'overwhelming' manner to their habits.

It may be of interest to mention that the ancient Jews recognised the uncleanly habits of hares in laying down the law as to what shall be 'clean' and 'unclean' flesh. They tried to base this on certain general laws of nature, which would have general application. In attempting to do this they got wrong in their Natural History, although they were sound in their hygiene, which was the purport of the prohibitions. 'And the Hare, because he cheweth the cud, but divideth not the hoof—he is unclean to you' (Lev. xi. 6).

It is believed that Mohammadans generally follow the same law, also Armenians and Laplanders: and it was forbidden food to ancient Britons on religious grounds: a very common device of enforcing a law which might otherwise be ineffective.

I have never known the Painted Partridge behave in any way which would make him suspect: I can hardly say the same of the Black Partridge, but my experience of him is not sufficient to have any weight. The Grey Partridge on the other hand used to collect round famine camps, and can often be seen round villages busy with excreta, and his breath is often unspeakable.

Both varieties of Jungle fowl are also suspect, sometimes quite definitely 'guilty': but not nearly so to the same extent as the grey partridge.

While on this subject I would warn your readers to vet any peacock they propose to eat. I have often turned out a lump of pure human excreta as big as a tennis ball, out of a peacock's crop: it is advisable, if near a village, invariably to smell the breath.

IVYBANK,
BISHOPMILL, ELGIN N.B.,
SCOTLAND.
January 12, 1937.

A. A. DUNBAR-BRANDER.

XIV.—CLOSE SEASONS FOR BIG GAME—ARE THEY BENEFICIAL?

It may be taken that a close season in respect of game animals and birds is imposed in order to ensure their being undisturbed during either the breeding season or when the young are being born.

There is no doubt that in the case of birds a close season is very necessary; but under present conditions it is becoming increasingly apparent that in India, except for a few areas very strictly protected, wholesale poaching of game of both sexes is such a serious menace that a close season now defeats its own object by allowing the poacher unhindered scope for his pernicious activities.

Further, in an examination of the close season (15th June to 15th October) as applying to South India it is found that the imposition of a close season to cover big game in general is of little value.

Sambhur:

Breeding season *mainly* November-December—Open season.
Young born, August-September (also June-July)—Close season.

Chital:

Breeding season *chiefly*, April-May—Open season (though breeding occurs, and young born, throughout the year, according to age).
Young born *chiefly*, November-December—Open season.

Muntjac (Jungle Sheep):

Breeding season: October-November—Open season.
Young born, April-May—Open season.

Chausinga (Four-horned Antelope):

Breeding season July-August—Close season.
Young born, January-February—Open season.

Bison:

Breeding season *mainly*, November-March—Open season (July-August to a lesser extent).
Young born *mainly*, August-December—Partly Open season (April-May also to a lesser extent).

Tiger:

Breeding season *chiefly*, April-May (also October-November)—Open season.
Young born *chiefly*, February-March (also August-September): Open season.

Panther:

Breeding season *mainly*, December-January (also May-June): Open season.
Young born mainly March-April (also September): Open season.

Bear:

Breeding season *chiefly*, April-May—Open season.
Young born *chiefly*, December-January—Open season (also August to a lesser extent).

Blackbuck:

Breeding season *chiefly*, April-May—Open season.
Young born, September-October—Close season.

Where lies, in the majority of cases, the protection a close season is supposed to afford? Under the circumstances, and in view of the fact that during the close season a very large number of animals are slaughtered by poachers who cannot then be disturbed by sportsmen in the jungles, I consider that a general close season in respect of big game should be abolished in South India.

HONNAMETTI ESTATE,
ATTIKAN P.O., *Via* MYSORE. R. C. MORRIS.
October 31, 1936.

XV.—OCCURRENCE OF THE RUFOUS SHORT-TOED LARK (*CALANDRELLA BRACHYDACTYLA DUKHUNENSIS* SYKES) IN NORTHERN BURMA.

The Fauna (2nd Edition) states that this Lark 'occurs in Burma', but apart from one specimen obtained by Dates near Pegu on April 25, 1880, no one seems to have observed or obtained it, and it has not yet been recorded from Yunnan. On April 6, 1936, I shot a single bird out of a flock of 20 or 30, which was feeding on a bare patch of stubble close to Myitkyina. The flock remained circling over the plain for the next half hour but when they eventually alighted, I was unable to find them again owing to the presence of a Peregrine Falcon. The weather at the time was unusual, very cold with occasional heavy rain-storms and possibly these birds were driven down from the higher hills. La Touche however noticed this species on passage in Eastern China between April 11th and 19th; I am quite certain that these are the first Short-toed Larks I have ever come across in Burma.

I am indebted to Mr. N. B. Kinnear for identifying this specimen which is now in the British Museum, with the other Burma specimen.

LONDON. J. K. STANFORD, I.C.S.
January 16, 1937.

XVI.—THE EGG-LAYING OF THE KHASIA HILLS CUCKOO (*CUCULUS CANORUS BAKERI* HARTERT).

We record an extract from an article by Mr. T. R. Livesey contributed to the *Times of India Annual*, 1937 in which the author gives his personal observation of a cuckoo depositing her egg in an inaccessible nest at Taunggyi, S. Shan States, Burma, on the 24th April 1936. The cuckoo concerned is the Eastern Cuckoo (*C. canorus bakeri*) and the selected fosterer was the Burmese Stone Chat (*Saxicola caprata burmanica*). The article in an amended form is reproduced by courtesy of Mr. Francis Lowe, Editor of the *Times of India.*

Mr. Livesey describes the incident as follows:—

'On April 22, at about 4 p.m., a cuckoo came flying slowly to the corner of the stubble field, some 60 yards from my cottage. It settled on the ground within 20 yards of me and began looking about. A pair of Stone Chats were in attendance and in much alarm. The cuckoo flew off, but shortly after returned and pitched in the field at about the same place. To watch it better I went in and got my field-glasses. The cuckoo had its mouth open and its throat feathers puffed out, and was panting like a domestic fowl on a hot day. The reddish marking on the neck showed it to be a hen bird. She began to move about as if searching for something, so I suspected a chat's nest there. After she had flown away I went and looked. Sure enough there was the chat's nest four yards from the fence. It was somewhat conspicuous, as the hole under a clod of earth in which it was wedged was the only hole in that vicinity. I could see it from some distance.

'The nest was of the usual type so common in the Shan States, wedged in a cavity under a clod of earth. The edge of the nest was visible, but one could not insert one's hand to touch the eggs, as the top of the clod overhung it. The entrance to the nest was about two and a half inches long, by about one and a half inches in height. By stooping down I could just see the three eggs it contained. They appeared to be fresh, and as the cuckoo had not laid, I thought there might be a chance of her returning to do so. I therefore had a 'hide' quickly erected on the other side of the fence. In it I was completely invisible, with a clear and uninterrupted view of the chat's nest five yards in front of me, and with its entrance hole facing me.

'I had not been in my hide more than a few minutes when the cuckoo flew back over the field. A few minutes later she flew towards me, but turned off out of sight again. For the next half hour nothing of note happened, and then suddenly I saw her flying straight at the nest. This time she pitched about three paces beyond the nest. She then began to move about in the stubble among the clods of earth, every now and again mounting a clod to see better. She was searching diligently for the nest! On she came till she was within three feet of the nest, and I thought that the Cuckoo's Secret was mine! Through my glasses set at +5 I could see every feather on her, and the edge of the chat's nest was as clearly seen as if it was but at arm's length away. But the cup was dashed from my lips!

'She appeared to fail to find the nest. The entrance hole was facing my way. Did she, or did she not know exactly where the nest was? This is a very interesting point. To my disappointment she passed off at a tangent down the field and out of sight. Fortunately she had not seen me. I waited till it was too dark to see but she did not return. Next day, April 23, I hung about from three o'clock in the afternoon till five, when not seeing anything of the cuckoo, I went off for a walk. The chat's nest now contained four eggs. I did not enter the "hide" at all but left my deck chair in it in case I should need to wait next day.

'Next day, April 24, the chat's nest had five eggs in it. I kept a good lookout for the cuckoo most of the day. It was cloudy and hot, and sounds of distant thunder came from the north. I had almost given up hopes of seeing the cuckoo when I suddenly saw her sail up into the one big tree by the house. It was about 5 p.m. but of course full daylight. I got my glasses on to her. She seemed to be the same hen bird. I left her sitting in the tree and hastened into my "hide". The chats were close to me and not suspicious. The cock chat broke into his short song and the hen fluttered down and entered her nest. I sat back in the chair and adjusted the glasses to +5, which gave perfect definition of the nest at five yards' distance. It looked as if I could put my hand on it!

'Suddenly the cock chat sounded his alarm note and on the instant the hen flew off the nest and up on to the fence over my head. Both chats became much alarmed and I suspected the presence of the cuckoo. Then down swooped the cuckoo with both chats in hot pursuit, but she passed beyond the nest and carried on out of sight. A few minutes later on she flew past again, but this time over the nest—again pursued by the angry chats. These were moments of tense excitement for all of us! Then she came again, and this time she pitched as she had done before, some three yards beyond the nest. Again she climbed up on the clods of earth searching in all directions for the nest. Both chats were wildly excited, and kept stooping at her in attempts to buffet her, which she resented by opening her beak and making faces at them—at the same time raising her crown feathers. A few drops of rain began to fall. The sun was obscured by cloud. This time she seemed to know where the nest was, for she came on direct to it.

'Just as Cuckoo's Secret was about to be revealed to me and my heart was thumping with excitement—of course—the Gurkha mali came up to put a mat on the hide—to put the lid on it! I drove him away.

'The cuckoo was still there! Hotly mobbed by both chats, she waddled up to the nest and thrust her head into it and as she did so, her tail, which was closed, was tilted up in the air. Her head was in the nest for but two, or three seconds, and then she withdrew her head and her body passed from a horizontal to an upright and vertical position as she spread out her wings on either side of her and depressed her tail, wide-spread now, in the act of laying her egg. As she laid a spasm shook her body with a quiver and this was distinctly noticeable in the region of the rump, and lower back down to the root of the tail. My impression was of a butterfly quivering with a pin stuck through it. It was without possible doubt the very act of laying. It only lasted about three seconds. While she was laying her head was concealed from me but she appeared from her attitude to be looking down watching herself lay. At that moment the infuriated hen chat landed high on the cuckoo's back between her shoulders and clung savagely on with spread wings to the parasite! The cuckoo held her position only for about three seconds, as I have said, and then she jumped backwards with a sudden movement, throwing off the chat, and flew off. Her egg was left in full view about three inches outside the chat's nest! She had tried her best but had failed to get it in the nest! She had not been hurried, disturbed or frightened in any way. The cuckoo had gone.

'I got out of the "hide" and went to examine the nest and the cuckoo's egg lying outside it. Her egg was warm and quite dry with a lovely matt bloom to it, undoubtedly straight from the oviduct. It was of the usual yellowish-pink marked type that appears to have been evolved to resemble the eggs of the stone chat. It was marked with a cap of markings but at the "wrong" —pointed—end of the egg. Her egg was on the small side, and it is possible that she was in her first season and not yet experienced in depositing her eggs.

'There were now only four chat's eggs in the nest, so the cuckoo must have removed one of the chat's eggs, but her movements had been so quick that I had not been able to see whether she had swallowed or flown off with it in her bill. My impression was that she had no egg in her bill when she flew off. The chat's nest had been slightly disturbed by the pressure she had exerted against the entrance in trying to lay her egg into it. Some particles of earth had fallen in on to the chat's eggs. It was at once a great triumph actually to have seen the cuckoo lay before me like this, but at the same time somewhat of a disappointment, as her eggs had fallen outside the nest—a catastrophe that may occur perhaps only once in a hundred times. As the chat's nest was one that a cuckoo could not possibly get onto to sit upon, I half expected to see the cuckoo lay outside the nest and then pick up her egg and place it in the nest with her bill—a method she is suspected to use when such difficulties are present. What I saw however was the unexpected.

'I am inclined to think that I saw the cuckoo lay her egg in the usual way when confronted with an inaccessible nest. Another observation I made this year confirms it.

'But on the whole, I think it is unlikely that the cuckoo has more than one way of getting her eggs into an inaccessible nest, and that the way I have described will eventually be established as the cuckoos' normal and usual way of meeting the difficulty.'

TAUNGGYI, BURMA. T. R. LIVESEY.

February 28, 1937.

XVII.—CUCKOO INCIDENTS.

Those interested in the cuckoo will have read with the greatest interest the account of a cuckoo laying at an inaccessible nest as recorded by Mr. A. E. Jones and his wife near Simla.

I think that there was nothing abnormal in the behaviour of the cuckoo. What happened bears out my own observations. The cuckoo apparently decided to lay at an inaccessible Stone Chat's nest—and after the usual preliminary flight, or flights, to the vicinity of the nest as a preparation to laying—spread out its wings and tail, and tried to lay, or squirt, its egg into the Chat's nest: but owing to the inaccessibility of the nest the cuckoo only got its egg on to the edge of the nest.

The observation unfortunately was a chance one, and Mr. Jones does not make it clear exactly how far he was from the nest when the laying took place—nor does he say if he had field-glasses to observe it with.

The incident was very much the same as the one described by me as the second incident in my article 'The Cuckoo's Secret', published in the last *Times of India Annual* and recorded above, in which I saw, at about forty yards distance, a rough-and-tumble scrap between a cuckoo, two chats and a pipit at a pipit at a pipit's nest. In that case however the cuckoo got its egg safely into the pipit's nest, but it had not apparently sat on the nest to lay as is delicate dome was undamaged.

But observations by chance are not good enough to be of real value. We must, like Mr. Edgar Chance, sit up over the nest in a hide at a few feet distance from the nest and coolly await the coming of the cuckoo, with the aid of camera and glasses. Then there is a good chance of observing exactly what takes place.

From my experience the spread-eagle position of the cuckoo, with wings and tail expanded and the tail depressed, even crushed onto the ground—is *the laying position* at inaccessible nests and I have no doubt the cuckoo that Mr. Jones saw, assumed this position when she actually laid at the nest entrance though it may have escaped his observation at the time.

As to the possible regurgitation of the egg, I agree that such a feat was not performed in this particular instance. The regurgitation theory was killed by Mr. Edgar Chance's work as long ago as 1921, and I understand that that theory is not regarded seriously any longer. If anyone suspects that cuckoos regurgitate their eggs, they have only to shoot a cuckoo that is coming to lay and they can then see for themselves whether the egg is in the throat or in the oviduct. In this connection it may be mentioned that cuckoos are apparently in the habit of removing the fosterer's egg *first*—and laying afterwards. That would be an awkward preliminary to regurgitation !

Also the condition of the cuckoo's egg shows it to have come straight from the right end of the bird. Again in regurgitation there would be no need to depress and spread out the tail—*au contraire*—nor would the spasm of laying be observed in the lower back of the cuckoo and in the region of the cloaca.

In Mr. Jones' summing up Nos. 1, 2 and 3, are very true, I think, and interesting. It seems to me that the attitude of the intended dupes before being victimised may well be very different from their attitude when the act of parasitism is being actually carried out. In the preliminary association of the cuckoo and the intended fosterers, it may be that the cuckoo exerts some hypnotic influence over the latter. The curious 'stuck' look on the cuckoo's face as she sits side by side with the fosterers for some considerable time is most striking and strongly suggestive of hypnotism.

As to the attitude of the fosterer when it finds a cuckoo's egg just outside its nest that can be ascertained by setting up hides over various nests and playing tricks on them with Bulbul's eggs, or sparrow's eggs. I do not think that birds take the least notice of eggs *other than their own*—no matter where they are situated. I have found cuckoo's eggs lying outside chat's nests—quite close to the nest entrance, and apparently just as laid by the cuckoo. In these cases the chats did nothing to remove them apparently.

Birds can have no *inherited appreciation* of any other eggs but their own. Only in the case of the parasitic cuckoos do we find a bird that inherits an appreciation of another bird's eggs. In their case it is a necessity, I maintain, in the evolution of their parasitic habits.

Finally it is noteworthy that cuckoos coming to lay are given to ruffling up their throat feathers—opening their mouths and panting. In other notes I suggested that the large and orange gape of the cuckoo operated as a warning when it is disturbed as a fledgling. This warning note may well continue into adult life to save it from the attention of hawks, etc., and be again employed in its combat with the intended fosterers when it comes to lay. That is my explanation of the cuckoo's habit of opening its mouth at the onslaught of the dupes.

It has been said that if a cuckoo were to squirt her egg into an inaccessible nest from a distance of several inches that her egg falling onto the fosterer's eggs would break them. I have just carried out two experiments in this connection. The first was to 'shoot' a cuckoo's egg into a nest of chat's eggs from a distance of four inches by propelling it between thumb and forefinger as a boy 'shoots' a marble. I had four chat's eggs in the nest. I found that when the cuckoo's egg landed fairly on a chat's egg that it broke it, that is to say, it broke *one* egg about three times out of four or five shots.

My next experiment was to find out whether the chats removed such cracked or broken eggs from their nests. I went round and broke a single egg in several chats' nests and then visited them again shortly afterwards. I found that such damaged eggs had been removed—got rid of. I think that these two experiments show how it is that we do not find the eggs of the fosterer damaged in any way by the cuckoo having squirted her egg in onto them from a distance. Her egg does in many cases break one of the fosterer's eggs, but that the fosterer very soon gets rid of the damaged egg.

TAUNGGYI, BURMA. T. R. LIVESEY.

February 28, 1937.

XVIII.—A NOTE ON THE DISTRIBUTION AND NIDIFICATION OF THE NORTHERN YELLOW-FRONTED PIED WOODPECKER [*LEIOPICUS MAHRATTENSIS BLANFORDI* (BLYTH)] IN SIND.

The Northern Yellow-fronted Pied Woodpecker is a permanent resident and not uncommon in Cutch, Kathiawar, North Gujerat and Mount Abu.

In Sind it is scarce and only locally common.

Blanford met with a pair at Umarkot on the Eastern border of the Nara Valley in the Thar Parkar district, and his collector obtained another from Kotri. Murray secured a single specimen from Sehwan, while Butler saw several skins from Hyderabad.

Scrope Doig believed that it bred in the Eastern Nara in April. Blanford as mentioned above, met with it at Umarkot, and when there in March 1936 myself, I was reliably informed that it was not uncommon further south, round about Nabisar, Char and Samaro.

Hume surmised, from descriptions given him, that it occurred in the Khirthar. Ticehurst however remarks that he is certain this is not the case. I might mention here, that I failed to meet with it around the hills at Tirith Laki, below Sehwan, and also further south in the Surjana hills.

I first met with it at Khebar, Hyderabad district, in March 1929, where I came across a pair feeding in a babul *huri*.

A few days later a single bird, a female, was seen feeding on a roadside *kandi* tree between Saidabad and the Kot of Pir Jhandowallo.

In Upper Sind, I failed to meet with it in the Sukkur, Upper Sind Frontier and Larkana districts, though I spent four summers in Sukkur and one in Jacobabad.

On the 18th March 1934 I again came across it, meeting a bedraggled female feeding on a roadside babul between Daro and Laikpur on the Pinyari canal east of the Indus, in the Karachi district.

The general condition of the bird and the presence of a marked incubation patch clearly indicated that the bird was a brooding female. The nest however could not be located.

At Jhok, a few miles south east, on the 22nd of the same month, I found a nest containing three callow young, in a roadside babul tree.

The nest was about 15 feet high and the entrance, which had obviously been cut by the birds themselves, 1⅛ inches in diameter. The young were being fed by both parents. Grubs and insects were evidently plentiful as the adult birds were seldom away from the nest for a period longer than 15 minutes.

A pair of Rose-ringed Paroquets (*Paleaornis torquata*) had a nest on the same tree and, one of them, the male, who perched on one occasion rather close to the woodpeckers' nest was fiercely attacked and driven off by the male woodpecker.

At Mirpur Bathoro, about 8 miles south of Jhok, I found five nests between the 23rd and 27th of March 1934.

The nests which were all on babul trees and situated from 20 to 30 feet high, contained either young or eggs, or were in the making, both sexes sharing the labour of wood cutting.

At Musani and Jati, further south, between the 3rd and 7th April I again met with it along the banks of the Pinyari, Gadap, Gungroo and Sher Khan canals, and found several nests, either in the making or containing young or well incubated eggs. All nests, which were from 20 to 30 feet high, were in babul trees, and as a rule were cut in a partially decayed branch or trunk.

West of the Indus, I have met with this woodpecker at Ghora Bari and Mirpur Sakro, in the Karachi district.

At the former place I came cross a pair on the 10th December 1934 feeding on babul trees on the banks of the Nasir canal near Sanwalpur and at the latter, a pair was met with feeding on babul trees on the banks of the Jaro canal on the 15th of the same month.

On the 9th October 1935, a pair was met with feeding on roadside babul and *kandi* trees near Sakrand, on the borders of the Nawabshah and Hyderabad districts.

In December the same year however, I was encamped at Sakrand for 9 days but failed to locate it again.

At Mirpurkhas, Thar Parkar district, on the 22nd March 1936 I came across a pair feeding on babul and *kandi* growing alongside the Jodhpur Railway embankment, but was unable to follow up my find as I was under transfer to Karachi and left Mirpurkhas the day following.

This woodpecker is very partial to dry open country, away from which it is seldom met with.

In such tracts east of the Indus, drained during the Abkalani season by the Pinyari canal and its many distributaries, in the Karachi district, it is common and a permanent resident, elsewhere I am inclined to believe that it occurs only as a straggler, except perhaps in the Thar Parkar district, where it may breed in the drier parts of the Nara valley, and in the lower portion of the Hyderabad district adjoining the Jati and Mirpur Bathoro talukas of the Karachi district, where it is abundant

It is common in Cutch, whence it probably extended to Sind, following in main, from about Lakhpat, the courses up stream of the Pinyari and Eastern Nara canals.

Like other members of the family it mates for life and hunts in couples.

When the young are able to fly the family keeps together for a considerable time and the young are apparently driven off by the parent birds only on the approach of the mating season, which begins early in March.

The habit both sexes have of giving voice to fairly loud 'chucks' when feeding, gives the position of the birds away and once a bird is thus located its mate will invariably be found in the vicinity.

The birds apparently 'chuck' to each other to avoid being too widely separated, as no matter what direction a feeding bird takes, it is followed up by the other. At times the second bird arrives at a tree before the departure of the first, but following the leader systematically from tree to tree is not a hard and fast rule.

Invariably a general direction is taken, the birds keeping to separate trees and only occasionally meeting.

At Mirpur Sakro in December 1934 I noticed that a pair which had evidently bred in a babul tree in the compound of the Rest House the season previous, used to return daily at dusk and roost for the night in their old nest hole.

The entrance of the nest, which is always neatly cut, is invariably about the size of a rupee and though old nests are at times reoccupied, the birds as a rule prefer to cut out fresh nest holes each breeding season, as I came across many old nests, the majority in babul trees, a few in *kandi* and old *lai*, during my rambles along the banks of the Pinyari canal and its distributaries in the Mirpur Bathoro and Jati talukas of the Karachi district.

As a rule nests were cut in partly decayed trunks or branches. I never found a tenanted nest in a wholly dead tree.

Around Jhok, Mirpur Bathoro and Jati in the Karachi district this woodpecker more or less replaces the Sind Pied Woodpecker

(*Dryobates scindeanus*) as I never met with both species in the same locality except at Mir Khano, where I came across a single pair of the latter, apparently stragglers, as I failed to find it again, though I met with quite a number of the former in the same locality and further south as far as Sando Bunder, a few miles below Mughal Bin, the headquarters of the Jati taluka.

In Sind, as elsewhere, the full clutch of eggs laid appears to be three. I never found more than three eggs or young in a nest.

Eggs taken in Sind are inseparable from those taken in the United Provinces.

KARACHI. K. R. EATES, F.Z.S., M.B.O.U.

September 6, 1937.

XIX.—THE DISTRIBUTION AND NIDIFICATION OF THE ROCK HORNED OWL [*BUBO BUBO BENGALENSIS* (FRANKL.)] IN SIND.

The Rock Horned Owl though rare in the plains of Sind is not uncommon in the Kohistan or hilly tracts of the Province.

It is partial to arid, hilly localities, where there are numerous ravines and deep, dry watercourses. In such places I have not only met with it, but found it breeding in the Karachi, Sukkur and Thar Parkar districts. J. M. S. Culbertson found a nest containing four fresh eggs, late in December, at Badin in the Hyderabad district. The nest was a depression in the ground at the foot of a mango tree by the side of a canal. An exceptional situation for the nest of this owl, which is not as a rule found near water.

Only on one occasion have I come across it in the plains of Sind. This was in the Mirpur Mathelo taluka of the Sukkur district, where, on the 26th February 1930 I found a pair nesting in an old Kubh near Ghari Chakar.

The nest was placed in a window-like recess about 12 feet high, inside the Kubh and contained, besides a single egg on hatching point, some clods of earth, a few bits of dirty rag and a small stick or two. The female sat very close and only left her nest after a small clod of earth had been thrown at her. The male flew out of the Kubh as I entered. He had apparently been seated in a recess similar to the one in which the nest was situated, as the ground below was littered with castings and the feathers of a Roller and a Ring Dove. The pellets, when broken up, were found to consist chiefly of the bones of small rodents. Below the nest I found, besides castings and feathers, some pieces of egg shell, which from their size and texture were unmistakably of this owl. Apparently the other eggs, only one was in the nest, had been displaced by the brooding female and had rolled out of the nest, as the recess was not more than about a foot in depth horizontally.

On the 18th March 1924 I found a nest containing two well incubated eggs, in a hole in the side of a deep, dry watercourse, in the hills west of Jungshahi in the Karachi district. The eggs were placed on the bare sand. The female sat close and was flushed off her nest by my approach and that of a Jokhio tracker, while we were following the spoor of a 'chink' along the bed of the dry nulla. The male was found perched on a *Khor* tree growing out of a clump of *Thuar* in a small ravine hardby. On the ground below were many pellets consisting chiefly of the bones of small rodents.

Again, on the 26th March 1931 in the Rohri Kohistan, near the ruins of the ancient city of Aror, in Sukkur district, I found a nest in the side of small ravine, overgrown with *Thuar* (cactus) and *Khor*, a species of *Acacia* which grows on stony hills in Sind. The nest contained two well grown young, one very much bigger than the other. Both parents were found in the same nulla, the female being flushed off her nest. The usual castings littered the ground below the nest and the *Khor* tree on which the male was seated. The pellets which were the usual, long, cylindrical ovals, about the size and shape of the egg of a Common Grouse, consisted, as those found on former occasions, chiefly of the bones of small rodents. Skull and maxillary bones with teeth intact being as before, very much in evidence. The nest, a hole about 2 feet deep and 18 inches in diameter was quite bare of any kind of lining and the entrance, which was below a large boulder, was partly concealed by a clump of dried, coarse grass.

As I approached the nest the young owls backed into their home, hissing alarm and making loud, snapping noises with their beaks. I took them to Sukkur, where they had the run of a back verandah and became very tame. About two months later however they suddenly sickened and died after a fortnight or so.

I was unfortunately unable to provide them with sufficient in the way of natural diet. Sparrows and mice they swallowed whole and made no bones about it. Though they greedily ate chopped, raw meat I am afraid that it eventually killed them, as when on this foreign diet, in the absence of birds, beetles, squirrels and mice, they made no castings for days and this disarrangement of Nature's working was, I am sure, the root cause of all their trouble. I was indeed sorry to lose Babbar and Takar, as I had named them. They made most interesting pets. More of them anon, as I hope some day to perpetuate their memory in an article devoted wholly to them.

On the 27th February 1936 I again found a nest, this time containing 3 young and an addled egg, in some sand bhits, about 6 miles north-east of Umarkot, in the Thar Parkar district. The nest, a hole about 2 feet deep and 18 inches in diameter, in the sloping side of a nulla, was partly concealed by a dried clump of Khip growing immediately above the entrance, and devoid of any kind of lining. The three young birds were all of different sizes. The biggest was quite three times the size of the smallest. The two older birds, one of whom was able to stand and walk and had its quill feathers sprouting, objected strongly to being handled and expressed their alarm and resentment, in the manner peculiar to owls, by making hissing noises and sharply snapping their powerful beaks. The youngest in fine down was just able to squat and balance itself precariously with the aid of its beak. The female sat very close and permitted me to approach within about 15 feet before she flew off. The nest inspite of containing 3 young was scrupulously clean. I found the male seated stolidly in a stocky *Khumbat* tree growing out of a dense clump of *Thuar* in a small ravine nearby, a bifurcation of the same nulla.

The feathers and feet of a Ring Dove were found at the entrance of the nest. Below, were the usual castings which consisted mainly of the head and jaw bones of small rodents.

Old castings littered the ground below a *Khumbat* tree, a species of *Acacia* which grows on sand bhits in the Thar desert, about 20 yards higher up the nulla, the presence of which told a tale and resulted in the discovery of the nest.

I was informed by Tharis that this owl is not uncommon in the sand bhits of Thar Parkar and a Kolhi tracker, who was with me at the time, told me that he knew of a ravine in some bhits about 8 miles south-east of Umarkot where a pair of these owls had had their home for years.

The ravine where the nest was found was about 12 miles, as the crow flies, from the nearest fresh water.

Since this owl has been found resident and breeding in Northern, Central and Southern Sind, both east and west of the Indus, it must also occur in the hills bordering the west of the Province, such as the hills around Pir Mangho, Khar, Surjana, Lakhi and the Khirthar range, besides isolated chains and groups scattered about the Province, such as the Makli ridge and the hills around Khadeji, Jhirruck, Pir Patho and Bram Hyderi, where there is suitable habitat for this owl.

Most places where the Rock Horned Owl is likely to be found are unfortunately off the beaten track of the touring official and the lack of water, food supplies, transport, fodder and communications, not to mention the intense heat, at times, even during the winter months are, in main, reasons why so little is known about this owl in Sind, as its domains are seldom encroached upon, except by ardent Shikaris after game, who have neither the time nor the inclination to bother about owls, even if they are 'horned'.

K. R. EATES, F.Z.S., M.B.O.U.

KARACHI.

November 26, 1936

XX.—OCCURRENCE OF THE CHINESE LESSER KESTREL (*CERCHNEIS NAUMANNI PEKINENSIS* SWINH.) IN NORTHERN BURMA.

In 1935 Mr. A. K. Thompson, Burma Frontier Service, sent me the unsexed skin of a Kestrel obtained in the Sumpralum Subdivision of the Myitkyina district. This proved, as I expected, to be

Cerchneis naumanni pekinensis, and the skin which has been identified by Mr. N. B. Kinnear, is now in the British Museum.

The only previous known occurrence of this Kestrel in Burma was recorded by me in the *Journal* (November 15, 1932) when I obtained two males in April out of a large gathering in South Pegu.

LONDON
February 6, 1937.

J. K. STANFORD, I.C.S.

XXI.—NOTES ON BIRDS OF PREY IN THE MADRAS PRESIDENCY.

Haliaëtus leucogaster (Gmel.) The White-bellied Sea-Eagle.

In volume xxxviii, No. 3, mention is made of this bird in the account of the Vernay Scientific Survey of the Eastern Ghats and the uncertainty regarding its distribution along the coast line of the Madras Presidency.

I have recorded the presence of this bird on Rameswaram Island and the Pamban Pass during all the months of 1930 excepting April, the greatest number being seen from September to November. I was unable to find any evidence of the bird nesting on the Island.

Further records have been kept by me from 1933 to 1935 of a pair which have nested at Cuddalore, the information collected is reproduced in the form of notes for easy reference.

28-11-33. Nest on a pipal tree about a mile inland and at a height of about 40 feet from the ground. One egg, fresh, white in colour stained with dirty yellowish and brown streaks which do not wash off. Size 2.73″ × 2.06″.

The birds were watched until 15-12-33 but did not lay again. The whole nest including a large part of the tree being blown down by a severe cyclone on that date.

22-11-34. The same pair it is presumed built a new nest, again on a pipal tree, about 200 yards away from the former one. This nest was about 30 feet from the ground and was not quite as large as the previous one. One egg, fresh, similar to the previous one, size 2.84″ × 2.05″.

15-2-35. Nest examined again as both parent birds were seen in the vicinity continually from 22-11-34. The nest contained one fledgling about the size of a country fowl. Remains of fish were seen on the ground below the nest, also a fresh sea snake about 18 inches in length. The parent birds merely flew round and did not attempt to attack the man who climbed the tree.

15-11-35. Both birds seen at the nest which was being reconditioned by them.

8-12-35. One bird seen sitting low on the nest. It was presumed the egg had been laid. One young one hatched and seen sitting in or on the edge of the nest during January 1936. This young one was seen during February sitting on or near the nest and was by that time practically the size of the parent birds. The colouring was not nearly so clear or defined as in the parent birds.

Both eggs taken are with me and are available for the museum collection if of interest.

Circaëtus ferox (Gmelin). The Short-toed Eagle.

In the account of the Vernay Scientific Survey of the Eastern Ghats, Part xiii, in Volume xxxviii, No. 3, of the *Journal* mention is made of only one record being available of this bird's nest being taken by Stewart in Travancore. Nothing further appears to be known of its habits in the Madras Presidency and in order to remedy the omission this note is submitted of my observations of the bird, its nest and the single egg obtained by me on 11-1-34 near Vallam Ridge at Tanjore. The nest, which was unusually small for the bird, was situated at about 12 feet from the ground on a thick and very thorny babool tree in scrub jungle. The materials used in the construction consisted of small dried twigs, the inside lining being of thinner twigs and some green mango leaves which had dried after being placed in the nest.

The bird under observation, one only having been seen, was a close sitter and although some stones were thrown at the nest that day it was found the bird merely raised itself in the nest and then settled down. The following day when the egg was taken the bird only left the nest when the men commenced chopping away the thorny twigs to enable them to climb the tree.

The single egg, which measures 3.00″ × 2.28″, was pure white and devoid of any gloss.

TANJORE. C. H. BIDDULPH.

February 9, 1937.

XXII.—UNUSUAL SITE FOR THE NEST OF THE WHITE SCAVENGER VULTURE [*NEOPHRON PERCNOPTERUS GINGINIANUS* (LATH.)].

A Scavenger Vulture was observed carrying nesting material early in February 1934 and on being watched the partly built nest was found on a termite hill situated in the waterspread of an irrigation tank. The termite hill was about five feet in height and was divided into two or three points at the top, the nest being situated between these points.

The site was quite exposed from every direction and the ground in the vicinity was not so wet as to prevent an easy approach to the nest.

The first egg, which was laid on 22-3-34, was taken immediately as it was feared that cowboys would destroy the nest and eggs. The egg which measured 2.80″ × 2.00″ was a very fine example of the reddish-white type profusely blotched with red brown.

Although the nest was watched for weeks no further eggs were laid, nor did the birds lay in the same nest in 1935. A pair of these birds did nest on a banyan tree on the tank bund nearby and I took two fresh eggs on 22-2-35.

The date is interesting as it is exactly a year later and I wonder if it may not be the same birds as nested in the tank bed in 1934?

These two eggs were faintly marked with fine red brown spots and measured 2.80″ × 2.00″ and 2.62″ × 2.00″.

TANJORE. C. H. BIDDULPH.

February 9, 1937.

XXIII.—BEHAVIOUR OF JERDON'S LITTLE RINGED PLOVER (*CHARADRIUS DUBIUS JERDONI* LEGGE) WITH YOUNG.

On the 21st March 1925 while working the banks of the Gogra river near Magarsee, Fyzabad district, I came across a pair of these birds on an unfrequented sand bank about 50 yards from the main stream.

The female on sighting me became very restless and tried her utmost to lead me away by running off in a direction directly opposite to that in which her nest was later located. As I approached the spot where both birds had originally been seen she became more and more agitated. Suddenly with a 'cheep' 'cheep 'che—ep', She took to wing playing the part of the proverbial damsel in distress exceedingly well. She fluttered along the ground, her tail spread, fanwise, downwards, shamming a broken wing, fluttering low, hesitating, shambling, pausing every few seconds to see if I was following her. I did follow her for a while, to see how far she would take me from her nest. She took me on gaily, keeping about 20 yards ahead the whole time, increasing or slackening her speed according to mine in order to keep her lead. After proceeding thus for about 100 yards I stopped. She continued her antics for a while, but finding that I was not following her, she stopped and after a moment or two, suddenly flew up with a sharp cry, took a swift half circle to my left, settled about 100 yards away and ran in a bee-line to a spot where lumps of dried blue-bull droppings were lying about and sat down quietly, settling herself in the sand. Her mate, who had run off in a different direction, uttering short, sharp cries, now stood and viewed the proceedings from a small sand ridge about 80 yards away, uttering an occasional, woeful 'cheep'.

I rooted my eyes to the spot where the female had settled herself, she was now quite invisible to the naked eye, and made straight for the place. As I approached I noticed her slipping off in a crouching position, just a momentary glimpse through the corner of my eye, as I dared not take my eyes off the exact spot where she had settled, and there I found on the edge of a small sandy depression, in the midst of scattered lumps of dried Nilgai droppings, a slight scraping, in which lay crouched two nestlings in down and an addled egg. The nest was devoid of any kind of lining. The tiny chips of drift wood or bits of dried grass or roots at times found in the nest of this Plover were quite absent.

The mottled nestlings lying with necks outstretched against a sandy-clay background were an ideal example of protective colouring and blended so well with their surroundings that a close inspection alone could distinguish them.

The young chicks, which could not have been more than a few hours old, as the egg shells were still in the nest, remained perfectly passive, permitting me to remove the addled egg and broken egg shells without making the slightest movement. They appeared to freeze instinctively and remained without any visible movement even when touched lightly with the tips of my fingers.

The parents remained some distance away, about 60 yards, making short agitated runs and uttering plaintive cheeps. I then moved away in an opposite direction to the parent birds, sat down in the sand about 40 yards away from the nest and waited developments.

The female was the first to approach her chicks, she settled about 10 yards from them and after a little hesitation made straight for them, uttering short, plaintive cheeps. The male meanwhile once again became very excited and did his utmost to lead me away from the nest by running off in an opposite direction and playing the broken wing game to perfection. I however paid not the slightest heed to his frantic efforts to entice me away and continued closely to watch his mate through prismatics. She went right up to her chicks but in place of settling over them as expected, she uttered low, twittering cries and to my surprise and interest, both chicks found their legs and tottered unsteadily after her, answering her calls with feeble 'peeps' and doing their little utmost to keep up with her. She led them a few yards from the nest and sat down with them in some sprouting tamarisk about four to ten inches in height, and there settled herself. Though now out of sight, I could still hear the faint 'peep-peep' of her chicks, which gradually died down to an occasional 'peep' and finally to complete silence.

The male meanwhile recovered his normal balance and after preening himself for a while began to feed on the sand bank, moving away from the spot where his mate had taken and concealed their chicks. I moved closer to the concealed female and when about twenty yards off noticed her slink away crouchingly through the sprouting tamarisk and take to wing about ten yards from her concealed young. She repeated her broken wing tactics, which were taken up by the male, who became more excited on this occasion than his mate, almost throwing himself into convulsions in his frantic efforts to attract my active attention, fluttering and rolling in a direction opposite to that taken by his mate. I went up to the patch of cover and found both chicks again frozen into immobility, lying side by side in the shelter of the sprouting tamarisk, necks stretched out, flush with the ground, eyes open, without the slightest movement, a part of the sand on which they lay as immobile as stone, and, so I left them. I once again moved away, but this time a good hundred yards and watched the scene through binoculars. The male soon joined his mate, alighting a few feet from her. She then moved off and after a moment or two flew directly to her chicks, and appeared to settle down. Shortly after she came out into the open and began feeding quietly a few yards from her mate, apparently satisfied that the strange human had come and gone in peace, and so I left them and their charming wee chicks.

K. R. EATES, F.Z.S., M.B.O.U.

KARACHI.
November 26, 1936.

XXIV.—INTERGRADATION OF THE RACES OF THE SPOT-BILLED DUCK (*ANAS POECILORHYNCHA* FORSTER).

By separate parcel post I send the skin of a duck which I recently shot. Could you very kindly tell me what species the duck is. It was shot on 25th November 1936 on a backwater of the Somkong river at the western end of the Pasighat subdivision of the Sadiya Frontier. The duck was in company with some Mallard and Gadwall and appeared to be the only one of its species in the flock from which I shot it.

R. E. PARSONS,
Astt. Political Officer.

PASIGHAT,
N. E. FRONTIER,
ASSAM.
December 10 1936.

[The duck obtained by Mr. Parsons is a spot-billed duck (*Anas poecilorhyncha*) but as it could not be exactly identified with the typical form, or with the Burmese race (*A. p. haringtoni*) or with Eastern form (*A. p. zonorhyncha*), we submitted it to Stuart Baker who writes: 'The skin of *Anas poecilorhyncha* which you have forwarded to me is a most interesting one. It is exactly intermediate between *A. p. zonorhyncha* and *A. p. haringtoni.* Like the former, it has no posterior wing-bar but, like the latter it has a *green* speculum (as also in *poecilorhyncha*) and not purple-blue as in *haringtoni.*

As specimens of *A. p. haringtoni* have been obtained in Assam which were quite true to type I should prefer to call this particular specimen an aberrant *haringtoni* rather than an aberrant *zonorhyncha*, though either term would apply equally truly.

I obtained specimens of this duck in the Dibrugarh District (*J.B.N.H.S.*, vol. xxii, p. 850) as did others, while Stevens shot a fair number in North Lakhimpur (*ibid* vol. xxiii, p. 743).

The great point of interest in this individual is the way it shows how geographical races tend to vary in the direction of those nearest to them in geographical distribution.'—EDS.]

XXV.—OCCURRENCE OF MALLARD (*ANAS PLATYRHYNCHA* LINN.) AT HOSHANGABAD.

On January 8th 1937 I saw seven mallard (*Anas platyrhyncha*) on a jheel in the Hoshangabad district of the Central Provinces and watched the birds through binoculars and eventually shot one, a drake. There were 2 drakes and 5 ducks. I understand that the mallard is a rare visitor to the Central Provinces. The abnormally cold weather of January 1937 perhaps accounted for this unusual migration.

HOSHANGABAD, J. MILES STAPYLTON.
February 6, 1937.

XXVI.—THE NUKHTA OR COMB DUCK (*SARKIDIORNIS MELANOTOS* PENNANT) IN ASSAM.

On the 11th instant I came across three of these birds, they were separated from each other, only one being within range, which I promptly bagged, a young drake. The other two went off after my shot. On looking up Stuart Baker's book on 'Indian Ducks' I find he mentions these birds having been found in Cachar, Sylhet and the North Lushai Hills, but makes no mention of Assam itself.

On referring this particular instance to Mr. John Higgins, our Commissioner and a well-known authority in Assam on such feathered game, he writes to say 'I have never heard of a Nukhta in the Assam Valley. I saw two that had been shot on the Loktah lake in Manipur in cold weather 1911-12-, etc.'

I shall be glad to hear through readers of your *Journal*, in Assam whether they have seen or heard of this duck being shot.

NAGAGHOOLIE TEA ESTATE, W. M. LE MARCHAND.
OAKLANDS, P.O., DIBRUGARH, T.O.
February 19, 1937.

XXVII.—OCCURRENCE OF THE GREAT-CRESTED GREBE (*PODICEPS CRISTATUS CRISTATUS* L.) AT MAYMYO, UPPER BURMA.

A single bird was seen on the lake at Maymyo, 3,500 ft., in Upper Burma, on the 8th March 1937. It stayed for four days, sitting most of the time in a patch of reeds growing up out of the water in the middle of the lake. It was first spotted by Major Sullivan of the Burma Rifles, who pointed out the bird to me. Records of this bird are few enough to make it worthy of mention. Previous records in Burma are listed by Stanford (*Ibis*, April 1935, p. 279).

MAYMYO, P. F. GARTHWAITE, B.F.S.
March 14, 1937.

XXVIII.—BIRDS AND ANTS.

I can give another example of the action referred to in Note xxv on pages 624-631 of vol. xxviii. When in Shillong on 15th June 1924 I was in the bungalow and in the evening watched a Drongo, which flew down onto the ground on the path outside the window, and was picking up ants. It picked up an ant in its beak and then applied its beak to the root of its tail (and occasionally also beneath its wings, so far as I could see) and then swallowed the ant. It repeated this performance for quite five minutes.

RODBOROUGH FORT, T. BAINBRIGGE FLETCHER.
STROUD, GLOS.
January 17, 1937.

XXIX.—A BLOODSUCKER (*CALOTES VERSICOLOR*) ATTACKING AN ADULT BIRD.

Such an attack was recently observed by me and as the circumstance was considered unusual it was decided that it may be worth recording.

While walking along an irrigation channel bund one evening the noise made by two larks and their behaviour caused me to stop and watch what was a serious battle between them. One bird slightly depressing its wings and moving its head up and down advanced towards the other, which on its part backed away although in the same attitude and just as prepared to fight.

Unobserved by me the bloodsucker, which was a largish male, suddenly darted out from some small bushes when the larks met and were rolling about together, having as it seemed their beaks locked. He grabbed one of the birds by the primaries, but almost immediately lost his grip as the bird fluttered away.

The bloodsucker moved away about a yard and settled down within sight of both the larks which within a minute or two resumed the fight, apparently quite indifferent to the fact that their attacker was so near.

The fight between the birds was very shortly after interrupted by some urchins coming up to see what I was watching.

Instances are known of bloodsuckers visiting nests of small birds and eating the eggs and nestlings and it may even be possible for them to catch and kill fledglings of the smaller species of birds, but in this instance it would appear that the bloodsucker actually attempted to secure a fully grown bird and it is wondered what he would have done with it even had he succeeded in killing it.

TANJORE. C. H. BIDDULPH.
February 9, 1937.

[Swallowed it.—EDS.]

XXX.—THE BUTTERFLY (*RHINOPALPA POLYNICE BURMANA*) IN THE N.-E. FRONTIER, ASSAM.

It may be of interest to readers of the *Journal* to know that—although it is reputed to be rare and is stated to be so in in Brigadier W. H. Evans' book *The Identification of Indian Butterflies*—the butterfly *Rhinopalpa polynice burmana* is, I have happened to discover, most exceedingly common in a narrow strip of country about ten miles long by about two miles wide near here. I have not succeeded in finding the larvae; but from June to September during breaks in the monsoon, when it is fine and warm, this strip of country literally swarms with this butterfly and a dozen perfect specimens can very often be netted almost without moving one's feet. I do not know if the fact that it is so common is in any way extraordinary; but I write in case it is. I recently sent a specimen of this species to the Society and you very kindly confirmed my identification.

R. E. PARSONS,
PASIGHAT, N.-E. FRONTIER, ASSAM. *Assistant Political Officer.*
March 7, 1937.

XXXI.—CURIOUS BEHAVIOUR OF A WASP.

While at work recently in a railway carriage provided for my use I noticed a small wasp enter one of the half-open windows carrying a ball of clay with which it proceeded to work on an egg cell on one of the venetian shutters. By the side of this cell and about an inch away from it was a crescent-shaped mass of clay, presumably the beginning of a second cell.

Later when looking at the venetian shutter to see how the wasp had progressed I noticed that it had made similar attempts at cell construction on three other shutters on the same side of the carriage. The cells in each case were similarly situated (i.e.) on the left side of the shutter and on the fourth cross piece from the top in three shutters and on the second from the top in the fourth. It was also observed that it was at work on two cells at the same time on three shutters, while in the fourth it had just commenced on one cell.

The carriage had been on a siding for some days with all the venetian shutters up and in consequence being practically dark it would appear that the wasp had entered through some opening each time and had worked, but practically every time on a different shutter.

On occupying the carriage all the shutters were kept half open and in the bright light the wasp had concentrated on the same shutter and had completed one cell by the afternoon but had not commenced filling it with caterpillars or spiders when the carriage had to be moved and in consequence a very interesting observation was interrupted.

The points that strike one in the above are:—

(1) The fact that the wasp had not noticed that it was working on four shutters simultaneously.

(2) That it had at times come to shutters on which there were no signs of its previous work and this fact had not been noticed.

(3) The way in which it had located the two cells is practically the same spot on each shutter (i.e.) on the left side and on the fourth cross piece in three cases.

(4) The fact that having got three pairs of cells exactly similar in location it had made a mistake with the fourth.

(5) That it had never gone to any of the windows on the opposite side of the carriage.

(6) That it was working on two cells on each of three windows at the same time, the cells being not more than an inch to an inch and a half apart.

(7) The fact that once it had the carriage reasonably lighted it did not work on any of the cells on the three remaining windows.

I regret not having secured the wasp for identification, but at the same time this is considered of little importance as my note is not an attempt to impute such behaviour as peculiar to a particular species of wasp, but rather to point to the idiosyncrasy of the wasp under reference.

Further observations :—

On 21-10-36 my carriage was again at Kumbakonam, having been there for three days on the same siding. On inspection of the windows it was found that there were then seventeen partly built cells on the first shutter, eighteen on the second shutter, eleven on the third shutter; all situated on the last four cross pieces of the venetian shutters. The fourth shutter had three partly built cells, two being on the last two cross pieces and one on the fifth cross piece from the bottom.

All the above cells were on the same shutters as were used previously and had been built by the wasp in three days. The time interval between the two observations being approximately six weeks.

It would appear that the fact that the same carriage was used and exactly the same four shutters, that it was the same wasp, but what does not seem clear is how the wasp after a lapse of six weeks was still alive and in the condition to construct so many egg cells.

TANJORE. C. H. BIDDULPH.

February 9, 1937.

PROCEEDINGS OF THE ANNUAL MEETING OF THE BOMBAY NATURAL HISTORY SOCIETY.

The Annual General Meeting of the Society was held at the Prince of Wales' Museum (New Wing) on Thursday the 18th March 1937 at 6-15 p.m. The Hon'ble Sir Robert Bell, K.C.S.I., C.I.E., I.C.S., was in the chair.

AGENDA.

1. Reading of the Annual Report of the Committee.
2. Presentation of the Balance Sheet and Statement of Accounts for the past year.
3. Election of the Committee.

Mr. P. M. D. Sanderson, Honorary Secretary, announced the election of the following 68 new members since the last Annual Meeting.

Mr. F. C. Badhwar, Calcutta; Mr. Noel Exshaw, France; Mr. E. J. Langleson, Bombay; Mr. H. E. Burgess, Coonoor; Mr. Mg. Tun Yin, Rangoon; Mr. M. R. Gokarn, Kalyan; Miss Winifred H. Baker, Lahore; Mr. M. G. Champion, Roorkee; Capt. G. McElligot, Bombay; Mr. U. B. H. Dunbar, Burma; Mr. Jal. N. D. Tata, Bombay; Mr. P. M. Hubbard, Dera Gazi Khan; Mr. Ralph Sasson, Calcutta; Capt. G. K. Graham, Miranshah; H. H. The Maharaja of Mayurbhanj, Baripada; Mr. L. N. Bhagvat, Bombay; H. H. The Heir-Apparent of Malerkotla, Punjab; Mr. Tun Kyan, Burma; Mr. G. A. Hodson, Burma; The Librarian, Museum of Comparative Zoology at Harvard College, U.S.A.; Mr. W. McF. Russell, Bombay; Mr. R. G. Griffith, Calcutta; The Belgaum Club, Belgaum; The Chief Saheb of Miraj, Jr., Miraj; Miss Meherbai P. M. Dalal, Bombay; Mr. H. A. Maxwell, Rangoon; H. H. The Raja Saheb of Akalkot, Akalkot; Mr. J. N. Corbett, Ceylon; Mr. C. S. Iron, Coorg; Mr. D. F. F. Chisholm, Calcutta; Miss Perin P. M. Dalal, Bombay; Mr. R. A. Bailey, Jubbulpore; The Principal, Shri Shivaji Preparatory Military School, Poona; The Mahableshwar Club, Mahableshwar; H. E. Sir John Hubback, K.C.S.I., I.C.S., Governor of Orissa; Rev. E. G. Nichols, Madura; Dr. F. E. R. Laborda, Calcutta; Mr. C. H. Biddulph, Tanjore; Mr. V. N. ff. Powell, Bandiqui; Mr. A. A. Marr, Calcutta; Mr. H. E. Richardson, Tibet; Kumar Amar Singh, Gaya; Mr. A. E. G. Davy, Ferozepore; Mr. A. C. Cotton, Sholayar; H. E. The Most Hon'ble Marquess of Linlithgow, Viceroy of India; Mr. Rolf Benkert, Bombay; Mr. G. Ahmed Khan, Aurangabad; Mr. P. W. Craker, Asansol; Mr. A. I. R. Stevenson, Shillong; Capt. S. W. A. Love, Shillong; Capt. A. V. Morton, Bombay; Major H. G. Rossel, Meerut; H. H. The Maharana of Lunawada; Mr. S. D. Bamjee, Asansol; Major C. L. B. Duke, Dehra Dun; Mr. G. Warren, Assam; Mrs. Victor Noel-Paton, Bombay; Mr. R. D. Sethna, Poona; Mr. C. G. Demetriadi, Calcutta; Mr. G. D. L. Millar, Assam; Mr. J. A. M. Symns, Burma; Dr. B. M. Joly, Agra; Capt. C. I. Boyle, Agra; Mr. D. G. Meston, Assam; Mr. W. B. Cooke, Valparai; Dr. B. A. Lamprell, Assam; Mr. J. Thackeray, Assam; Capt. H. F. Walker, Bombay.

The following proposal was accepted :—

Vice-President.—Rt. Rev. R. D. Acland, Lord Bishop of Bombay, in place of the Hon'ble Sir Robert Bell, K.C.S.I., C.I.E., I.C.S.

Executive Committee.—Mr. A. Forrington, Mr. C. G. Freke, C.I.E., I.C.S., Mr. D. G. Hill, Lt.-Col. C. G. Toogood, D.S.O., Dr. S. A. Wilkinson, M.R.C.S., L.R.C.P.

BOMBAY NATURAL HISTORY SOCIETY.

OFFICE BEARERS—1937.

Patron.—His Excellency the Viceroy of India.

Vice-Patrons.—H. H. The Maharao of Kutch, G.C.S.I., G.C.I.E.; H. H. The Maharaja of Jodhpur, K.C.S.I., K.C.V.O.; H. H. The Maharaja of Rewa, K.C.S.I.; H. H. The Maharaja of Bhavnagar; H. H. The Maharaja of

Travancore, G.C.I.E.; H. H. The Nawab of Junagadh, K.C.S.I.; Mr. F. V. Evans, Liverpool; Sir David Ezra, KT., F.Z.S., Calcutta; Mr. A. S. Vernay, New York and London; Lt.-Col. K. G. Gharpurey, I.M.S. (Retd.).

President.—H. E. The Right Hon'ble Lord Brabourne, G.C.I.E., M.C.

Vice-Presidents.—H. H. The Maharao of Kutch, G.C.S.I., G.C.I.E.; Rev. Fr. J. F. Caius, S.J.; Rt. Rev. R. D. Acland, Lord Bishop of Bombay.

Executive Committee.—Mr. H. D. Ash, Mr. Farrokh E. Bharucha, Sir Alwyn Ezra, KT., F.R.G.S., F.Z.S., Mr. A. Forrington, Mr. C. G. Freke, C.I.E., I.C.S., Mr. J. B. Greaves, J. P., Mr. D. G. Hill, Lt.-Col. S. S. Sokhey, I.M.S., Lt.-Col. C. G. Toogood, D.S.O., Dr. S. A. Wilkinson, M.R.C.S., L.R.C.P., Mr. P. M. D. Sanderson, F.Z.S. (Honorary Secretary), Mr. H. M. McGusty (Honorary Treasurer).

Advisory Committee.—Dr. C. F. C. Beeson, D.SC., M.A., I.F.S., Dehra Dun; Lt.-Col. R. W. Burton, I.A. (Retd.), Nilgiris; Mr. C. H. Donald, F.Z.S., Punjab; Dr. F. H. Gravely, D.SC., Madras; Mr. C. M. Inglis, B.E., M.B.O.U., F.Z.S., Darjeeling; Mr. R. C. Morris, F.R.G.S., F.Z.S., Mysore; Major E. G. Phythian Adams, F.Z.S., I.A. (Retd.), Nilgiris; Dr. Baini Prashad, D.SC., Calcutta; Mr. H. C. Smith, I.F.S., Burma; Mr. F. Wadia, Poona; and Mr. J. H. Williams, Coimbatore.

ANNUAL REPORT OF THE BOMBAY NATURAL HISTORY SOCIETY FOR THE YEAR ENDING 31ST DECEMBER 1936.

ADMINISTRATION

President.—H. E. The Right Hon'ble Lord Brabourne, G.C.I.E., M.C.

Vice-Presidents.—H. H. The Maharao of Kutch, G.C.S.I., G.C.I.E., The Hon'ble Sir Robert Bell, K.C.S.I., C.I.E., I.C.S., Rev. Fr. J. F. Caius, S.J.

Executive Committee.—Right Revd. R. D. Acland, Bishop of Bombay, Mr. H. D. Ash, Mr. Farrokh E. Bharucha, Rev. Fr. J. F. Caius, S.J., Sir Alwyn Ezra, KT., F.R.G.S., F.Z.S., Mr. C. G. Freke, C.I.E., I.C.S., Mr. J. B. Greaves, M.L.C., Mr. H. McGusty, Lt.-Col. S. S. Sokhey, I.M.S., Mr. A. Forrington (*Honorary Treasurer*), Mr. P. M. D. Sanderson, F.Z.S., *Honorary Secretary,* Bombay.

Advisory Committee.—Dr. C. F. C. Beeson, D.SC., M.A., I.F.S., Dehra Dun; Mr. T. R. Bell, C.I.E., I.F.S. (Retd.), Karwar; Lt.-Col. R. W. Burton, I.A. (Retd.), Coonoor; Mr. C. H. Donald, F.Z.S., Dharamsala; Dr. F. H. Gravely, D.SC., Madras; Mr. S. F. Hopwood, I.F.S., Rangoon; Mr. C. M. Inglis, B.E., M.B.O.U., F.Z.S., Darjeeling; Mr. R. C. Morris, F.R.G.S., F.Z.S., Coimbatore; Major E. G. Phythian Adams, F.Z.S., I.A. (Retd.), Nilgiris; Dr. Baini Prashad, D.SC., Calcutta; Mr. H. C. Smith, I.F.S., Burma; and Mr. J. H. Williams, Coimbatore.

Staff.—S. H. Prater, M.L.A., J.P., C.M.Z.S. (*Curator*); C. McCann, F.L.S. (*Assistant Curator*).

THE HONORARY SECRETARY'S REPORT FOR THE YEAR 1936.

The Society's Journal.—The Thirty-eighth Volume of the Journal was completed and Part I of Volume XXXIX was issued during the year.

MAMMALS.

Foxes of British India.—Papers on Mammals include Pocock's revision of the genus *Vulpes.* Blanford in his *Mammalia* recognised 5 species of Foxes as occurring in India. Pocock reduces the number to 4. The author considers that the Fox of the Himalayas and the Desert Fox are not distinct species but merely local races of the Common Fox of Europe (*Vulpes vulpes*). To the Himalayan Fox (*Vulpes alopex* of Blanford), he assigns the name *Vulpes vulpes montana* Pearson and to the Desert Fox (*V. leucopus*), the name *Vulpes vulpes pusilla.* A third race of the European Fox found in our limits is Blanford's Fox (*V. v. griffithii*) which ranges from Afghanistan as far east as Murree. The remaining three species of foxes found in Indian limits are the Indian Fox (*Vulpes bengalensis*), the small Afghan Fox (*Vulpes cana*) and the Tibetan Desert Fox (*Vulpes ferrilatus*). Of these three species the Indian Fox is the only fox indigenous to this country. Like the forms of the European Fox inhabiting the Himalayas and North Western India, the others are immigrants from the North and West which have not penetrated far into India proper.

The Blue Bear.—Among the contributions to the Society's Museum received during the year is the skin of the rare Blue Bear (*Ursus arctos pruinosus*), which was presented by Capt. R. K. M. Battye. The animal was said to have been killed near Hor in Eastern Tibet. A description of the specimen was published by Mr. Prater in Volume XXXVIII, No. 3. It is the skin of an immature animal and in general coloration resembles the skin of an immature male from the Minshan Mountains, U. Kansu, presented to the British Museum by Capt. Fenwick Owen and described by Pocock (*Journ. Bom. Nat. Hist. Soc.*, vol. xxxv, p. 809).

Leopard and Tigress.—A number of interesting notes on Mammals were contributed by members during the year. Among them is a note by Iftkihar Ali Khan, Heir Apparent of Malerkotla State recording a curious association between a leopard and a tigress, which as suggested by the editors, may have been brought about by the mating of these two animals. The larger Felidae have frequently interbred in captivity. Opportunities for such interbreeding under natural conditions must be rare, but the facts of the case as recorded suggest the possibility.

Horn replacement in Nilgai and Black Buck.—Mr. Hall's note on horn replacement in Nilgai and Black Buck appears to confirm the observations of Buffon and Ogilby on the subject of horn replacement in certain bovines and antelopes. The theory is that a new horn grows within the sheath of the older horn which is displaced, cracks and peals off. Mr. Hall's note elicited confirmatory evidence from a number of correspondents. The whole question raises an interesting point for further observation.

The degeneration of tusks in the Asiatic Elephant.—Correspondence which passed between Sir Frank Colyer and Mr. R. C. Morris brings into prominence the fact that the tusk in Indian Elephants is a degenerate organ and suggests that the trend of evolution in these animals is towards the development of a tuskless form. This is a condition almost established in the Elephant in Ceylon, while a similar tendency in the Indian Elephant is revealed in the number of males which fail to develop tusks and the number of elephants born with a single tusk or which develop one tusk only after shedding the milk 'tushes'. It is apparent that the two existing species of elephants—the African and Indian are merging into a number of forms. There is the long-trunked Sumatran elephant, the hairy Malaysian mountain form, and the tuskless Ceylon Elephant. In the African Elephant, divergence from type seems to centre in the form and size of the ears. It is probable however that under existing conditions, both the Indian and African species will become extinct before enough time has elapsed for any striking new forms to be established.

BIRDS.

Birds of the Madras Presidency.—Messrs. Whistler and Kinnear continue their papers on the Avifauna of the Madras Presidency, based on the collections made during the Vernay Scientific Survey of the Eastern Ghats. Parts xiii and xiv were published during the year. They cover the Birds of Prey, Pigeons and Doves, Game Birds and Waders. Two new races are described among the Birds of Prey—The Ceylon Crested Goshawk (*Astur trivirgatus layardi*), distinguished from the South Indian form by its smaller size and markings, and a West Himalayan form of the Besra Sparrow Hawk (*Accipiter virgatus kashmiriensis*) distinguished from the east Himalayan race by its paler colouration. Two new races of the Jungle Bush Quail (*Perdicula asiatica asiatica*) are recognised and described. *P. a. ceylonensis,* is a richly coloured Island race from Ceylon and *P. a vidali,* found along the Malabar coast, differs from the typical form in the deep reddish tinge of its whole upper plumage. The authors disagree with the view put forward in the *New Fauna* that the Rock Bush Quail (*P. argoondah*) is a race of the Jungle Bush Quail (*P. asiatica*). They revert to the view held by Blanford and Oates that the birds represent two distinct species. Since the publication of his review of the various races of Scimitar Babbler (*J.B.N.H.S.*, vol. xxxv, p. 72) Mr. Whistler has been able to examine a series of skins of this species from the Billigirirangan Hills which confirms his view that the birds of the Lower Eastern Ghats are distinct both from the typical race and from the race found in Travancore. The new Eastern Ghats race he describes under the name *P. horsfieldi maderaspatensis.*

Birds of Travancore.—Parts iv, v and vi of Mr. Sālim Ali's Ornithology of Travancore were published. The author's interesting ecological notes on the species listed by him enhance considerably the value of his contribution. New forms described in his reports, which are written with the collaboration of Mr. Whistler are:—The Travancore Weaver Bird (*Ploceus p. travancoreensis*), Waite's Pipit (*Anthus rufulus waitei*), a pale sandy coloured race from the desert and drier areas of North Western India, and the Punjab Sky-Lark (*Alauda gulgula punjaubi*), which differs from the typical form in its markedly paler coloration. The recognition of these northern races is based on the study of material made available as a result of various surveys organised by the Society since the publication of the *New Fauna.*

Birds of Bombay and Salsette.—Since the publication of EHA's classic book on the Common Birds of Bombay, a considerable advance has been made in our knowledge of the classification and distribution of Indian Birds. Messrs. Sālim A. Ali and Humayun Abdulali have undertaken the production of an up-to-date list of the Birds of Bombay and Salsette. The list which contains notes on field identification and habits of species is being issued as part of the series of pamphlets on the Fauna of Bombay and Salsette, published by the Prince of Wales' Museum. The work will provide a useful guide to students interested in the bird life of Bombay and its suburbs.

Other articles on birds include Major Bates' account of his collecting trip in the Kishenganga Valley, a little known area ornithologically and two contributions on the Indian Crested Swift, one by E. H. N. Lowther and the other by J. K. Stanford and H. C. Smith. Mr. Lowther's paper is illustrated by a series of unique photos taken by the author.

Additions to the Indian Avifauna.—In his notes on Rare Birds from Burma, Mr. Stanford records obtaining a specimen of the Brown Suthora on the Myitkyina-Yunan Border. According to Dr. Ticehurst, the specimen conforms to the Yunan race—*Suthora unicolor canastes* and, as such, is a new form to the Indian avifauna. Mr. C. E. Milner shot a Shrenk's Bittern (*Ixobrychus eurythmus*) on the Moulmein-Kyaikmaran Road in the Amherst District, Tenasserim. The species has never been previously recorded from Indian limits. To the two previous records of the occurrence of the Long-tailed Duck (*C. hyemalis*) in India we have now to add a third : a female obtained by Mr. Lambrick at Drig in Sind in December 1935.

Wanted information about Cuckoos.—We should like to draw attention to Mr. Stuart Baker's appeal for information about Cuckoos. There are many problems connected with the parasitic habits of these birds which await solution. Apart from the question of the cuckoo's method of depositing her eggs in inaccessible nests, there is the question of the method of ejection of the fosterer's egg. To what extent is this habit prevalent among Indian Cuckoos? Again, how do the fosterers solve the problem of rearing, when more than one cuckoo is raised in the nest? All these are interesting questions which can only be answered by careful recording of the life story of individual birds from egg to fledgling.

Another interesting point connected with cuckoos is raised by Mr. Livesey in his article on Cuckoo Problems. How has the approximation in colour and markings between the eggs of the cuckoo and her selected fosterer been brought about? Mr. Livesey looks elsewhere for a solution than the one offered by the theory of Natural Selection. He holds that design has played a considerable part in effecting this similarity, which he believes is the cumulative effect of a desire to produce a particular colour of egg held by a particular line of cuckoos for countless generation.

REPTILES.

Snakes of Deolali.—Papers on reptiles include a paper on the Snakes of Deolali by Mr. A. G. Fraser, I.M.D. Mr. Fraser is to be congratulated on the very intensive study he has made of the snakes of his district. His paper is a model to students engaged in field research. The author's objective is not only to provide a list of the snakes in his area but to study the various factors affecting the lives of snakes within the environment. His whole approach to the study is original and his notes on the osteological characters of snakes collected by him are particularly interesting and open up a fresh field for investigation.

The nesting of the King Cobra.—Messrs. H. C. Smith and F. J. Mustill's notes on the nest and eggs of the King Cobra is perhaps the first detailed description of the nest of this snake. It was generally known that the eggs of a hamadryad are laid in a heap of leaves, but the observations of the two writers indicate that the nest is more than a mere accumulation of leaves. It is a compact cup-like mass whose structure suggests a deliberate effort at nest building. Another interesting point revealed is that the snake does not sit directly upon the eggs but on a layer of leaves with which it covers the eggs. What we have still to discover is how the King Cobra builds this structure.

FISHES.

The Fishes of Travancore form the subject of a paper by Dr. C. C. John. The author provides a systematic list of the fishes of Travancore based on collections made in 1932-1933. He discusses method of capture, the factors injurious to the development of Fisheries in the State and recommends the introduction of Legislative measures to control existing methods of trapping and netting which have tended considerably to decrease the available supply.

Messrs. G. E. Shaw and E. O. Shebbeare describe a new species of fish of the genus *Glyptothorax* obtained in the Darjeeling District which they have named *G. horae* in honour of Dr. Hora of the Indian Museum.

INSECTS AND INVERTEBRATES.

The wasps of the genus *Ischnogaster,* remarkable for their unique nests are believed to form a link between the Solitary and Social Wasps because of their structural characters and their nesting habits. The larger species are as a rule solitary, their nests are built by a single pair. The smaller species live in a many-celled 'social' nest constructed by the community. Mr. T. R. Bell proposes a revision of the genus, wherein species of social habit are retained in the genus *Ischnogaster* and a new genus *Paravespa* is created for the solitary species, based on the distinctive structure of the mandibles in these wasps and in their peculiar nesting habits. Under the new genus *Paravespa,* Bell includes the species *eximia* from Ceylon and a new species *P. eva,* which is described by him. It is the only representative of the genus found in India proper. *Ischnogaster* is thereby now limited in its range to the Eastern Himalayas, Assam and the Indo-Chinese and Malayan countries.

Dragonflies.—Lt.-Col. F. C. Fraser describes two new species of Oriental Dragonflies: *Prothorthemis intermedia* and *Idionyx laidlawi.*

Caddis-Flies.—Part iv of Martin Mosely's monograph on Indian Trichoptera was published during the year. Further publication of this important work was suspended owing to reconsideration of the question of meeting the heavy cost of illustrations for these articles. The Society has made an application for a grant to meet this cost. Failing such financial assistance, the only alternative would be to extend the number of parts so as to spread the cost of illustrating the serial over a number of years. Mr. Mosely's work will probably remain for many years the standard work on Indian Trichoptera and it would be a pity to detract from the value to students of this most excellent work by curtailment of the plates and diagrams now being issued.

Butterflies.—Mr. D. F. Sanders' paper on the Butterflies of Secunderabad supplements the list of species recorded from this area by Col. Logan Home in volume xxxvii, No. 4 of the Society's *Journal.*

Lace Bugs.—A new species of Tingitid *Monanthia cheriani* is described by C. J. Drake from material collected by Mr. M. C. Cherian in Coimbatore.

South Indian Coccidae.—Dr. T. V. Ramakrishna Ayyar supplements his previous papers on South Indian Coccids, as a result of subsequent collections made by him. His new list contains 6 new species described by Green elsewhere and 7 species recorded for the first time from South India.

Botany.

Revd. Father Caius continues his papers on Medicinal and Poisonous Plants of India. Papers published by him during the year dealt with Medicinal and Poisonous Grasses, Orchids and Aroids of this country.

Flowering of Strobilanthes.—Very little is known about the periodical flowering of numerous species of *Strobilanthes.* Mr. P. V. Mayuranathan supplements Mrs. Robinson's useful contribution on the subject published in volume xxxviii of the *Journal* with a few further records. The planting community and others can do much to help in establishing the periodicity of the flowering in these plants by recording the time when the different species come into flower. Specimens in flower can be sent either to the Society or to Mr. P. V. Mayuranathan of the Government Museum, Madras for identification.

Beautiful Indian Trees.—With the publication of the article on the Padauk in the December issue of the *Journal,* the serial on Beautiful Indian Trees was completed. Thirty flowering trees of India have been described and illustrated in colour as well as in black and white. The thanks of the Society are due to the authors, the late Rev. Father Blatter and Mr. W. S. Millard, whose articles have given attraction to the *Journal.* They have now provided a popular and well-illustrated work on the trees which add so much to the beauty of our roads and gardens. This serial will be issued in book form about the middle of this year. By printing an extra number of plates when the articles were issued in the *Journal,* the Society has been able to keep the cost of the book at a remarkably low figure. The published price is Rs. 15 and Members may obtain copies from the Society at Rs. 10. Orders are now being registered.

Shooting and Fishing.—The *Journals* issued during the year contained a number of articles on shooting and fishing. Among them is the interesting account by Mr. R. C. Morris of his quest for a specimen of the Lesser One-horned Rhinoceros in the jungles of Perak for the American Museum of Natural History. The failure of the expedition helps to emphasise the fact that, as in Burma, the species is practically extinct in the jungles of Malaya, where it was once reported to be common.

Mr J. E. Hall gives an account of hunting Wild Buffalo in the jungles of the Kosi River. Sportsmen of small means (which in these days implies the average shikari)—but blest with abundant energy—will be interested in Mr. Hall's account of a shooting trip in the C. P. which was written to show how much can be accomplished with hard work and the minimum of expenditure.

Mr. W. S. Thom gives an account of the Malay Tapir from his store of reminiscences covering many years of hunting in the jungles of Burma.

Contributors to the Journal.—The Committee take this opportunity of thanking all those who have contributed articles or notes to the *Journal*. The *Journal* is a vital link between the Society and its members and this can only be strengthened by adding to the interest and attraction of the publication. In writing for the *Journal* members help not only in furthering the work of the Society but in sustaining and increasing its membership.

Donations.—Donations amounting to Rs. 9,945-15 were received during the year from :

H. H. The Maharaja of Travancore
H. H. The Maharaja of Bhavanagar
H. H. The Nawab of Junagadh
H. H. The Maharawal of Dungarpur
The Chief Saheb of Miraj, Jr.
Mr. F. V. Evans.

The donations have been credited to the Journal Fund to cover extra expenditure on the *Journal*. The Committee take the opportunity of expressing the sincere thanks of the Society to all those who have so generously contributed to this Fund.

THE MUSEUM.

The rearrangement of the Natural History Section in the New Wing was taken up during the year. The new galleries have been designed especially to provide for the requirements of a modern Natural History Museum. Each gallery has its complement of large diorama groups built in a series of alcoves—while the systematic collections are arranged in cases along the walls of the gallery. The whole arrangement is pleasing and attractive and avoids the heaviness and artificiality which comes from overcrowding the floors with show cases and the cases with exhibits. Suitable colour schemes have been adopted in each gallery to secure harmony between the cases, their backgrounds and the walls. A feature of the New Museum is the 13 large diorama groups, 8 of which were completed during the year. In the Bird Gallery three groups illustrate:—A nesting colony of Flamingos in the Rann of Cutch, the Griffon Vulture nesting on the cliffs near Bombay, and a Lämmergeyer's eyrie in the Simla Hills. Each group is a faithful reproduction of the nesting site based on photos, paintings and material collected on the spot. In the groups in the Mammal Gallery our objective has been not only to show some of the larger wild animals of the country in their natural habitat but also to give the visitor an idea of the varying nature of the country. Bison are shown in the shola-covered hills of South India, Blackbuck in the plains of Deccan, Tiger in the evergreen forests of Assam, Spotted Deer in the deciduous jungles of the C.P. and the Kashmir Stag in a Himalayan Forest. In the Reptile and Fish Gallery there is a submarine group of sharks and groups illustrating Loggerhead Turtles coming ashore to lay and a Malay Python in the setting of a Malay Jungle. A 20′ cast of this snake was made during the year and a perfect model produced. The Evans' collection of Marine and Fresh Water Fishes consisting of casts prepared from material collected in Bombay and other parts of India is shown in the gallery: and we take this opportunity of expressing our thanks to Mr. F. V. Evans who bore the entire cost of preparing these exhibits. A feature of the Fish Section is the fine murals which adorn the walls of the gallery. They are the work of Mr. A. Valleé whose services we were fortunate to secure. Our acknowldgment and thanks are also due to Col. Gharpurey who contributed Rs. 5,000 towards the cost of preparing and exhibiting the collection of reptiles. Among the snakes shown is a beautiful cast of the King Cobra, prepared from a live specimen presented by the Mysore Government.

Another phase of the work done during the year was the collecting of animals for mounting in these groups and also of various accessories for reproduction in them. Permission was obtained from the Madras Government for securing a female bison and calf to be set up with the fine male now exhibited. The specimens were obtained for the Museum by Mr. R. C. Morris to whom our thanks are due.

In March 1936, with the assistance of Mr. S. A. Vahid, I.F.S., Divisional Forest Officer, Khandwa, C.P., skins and the entire skeletons of a male and female Sambar were obtained. In the same month, the Maharaja of Bhavnagar kindly presented a set of male, female and young of the Blackbuck. While the Heir Apparent of Bikaner provided similar material for a group of Chinkara. Our thanks are also due to the Kashmir Durbar for presenting the entire skin and skeletons of a pair of Kashmir Stag which were obtained for us by the Game Warden.

The labelling of the exhibits in the entire Museum is being carried out in cellophane and glass. The method has proved quite successful. The labels are attractive and overcome the need for constant replacement which was an obvious disadvantage with paper labels which soon fade and are subject to mottling and discolouration.

It will be seen from the above report that the year was one of great activity calling for an exceptional effort on the part of the staff to which they responded with their usual enthusiasm.

REVENUE ACCOUNT.

This account shows a small deficit of Rs. 835-10-5 which can be regarded as distinctly satisfactory as compared with figures for the previous three years:—

Year.		Deficit.		
1933	Rs.	2,451	8	9
1934	,,	4,847	8	9
1935	,,	5,655	12	0
1936	,,	835	10	5

Actual receipts during 1936 amounted to Rs. 30,230-15-3 as compared with Rs. 26,847-7-11 in 1935. Subscriptions showed an increase of Rs. 1,597-0-10. The balance being made up by sales of Society's publications, a small profit of Rs. 239-0-8 on the Taxidermy Department and Rs. 706-14-6 due by members for outside work undertaken by the Society.

Expenditure shows a decrease of Rs. 1,486-10-3. This was effected by a drastic reduction in the cost of producing the Journals.

SALARIES.

It will be noticed that the salary bill in 1936 amounted to Rs. 18,225-12-0 as compared with Rs. 16,188-8-3 in 1935. In 1935 the services of Mr. McCann and two others were loaned to the Chindwin Expedition for about three months, during which time their salaries were paid by the expedition.

MEMBERSHIP.

During the year 1936, 58 new members and 2 Life Members joined the Society and 67 members resigned. One has to expect these resignations as senior officers, Civil Servants and others retire and every effort is made to retain their interests after they leave India. The Society offers to send the *Journal* to retired members, postage paid, for an annual subscription of one guinea.

The total number of members on the roll of the Society (excluding 192 Life Members) was as follows:—

31st December 1935	973
31st December 1936	964

GENERAL.

A satisfactory feature of 1936 was the response to the appeal for donations to the funds of the Society. The total sum collected was Rs. 13,769-3-0 which amount has been placed to the credit of the Special Journal Fund which now stands at Rs. 11,089-8-6 as compared with Rs. 3,823-4-0 at the end of the previous year.

STAFF.

The Committee wish to record their appreciation of the good work done by the Curator and his staff during the past year.

P. M. D. SANDERSON,
Honorary Secretary.

SNAKE VENOM.

A cinema film showing methods of extracting Snake venom at the Haffkine Institute, was shown by Lt.-Col. S. S. Sokhey, I.M.S.

Lt.-Col. Sokhey, speaking on the subject of snake venoms, described how perfectly they were adapted to their biological function of immobilising living and active prey and its subsequent digestion when swallowed whole. This end was achieved by the extraordinarily potent and very varied toxic properties of the venoms. These may be described as (*a*) action on the peripheral nervous system, producing muscular paralysis leading to death from failure of muscles of breathing, (*b*) direct action on the circulatory system, producing death from failure of heart, (*c*) action of the blood itself leading to clotting of blood in the vessels or to an entirely opposite action. There is also destruction of red blood cells, (*d*) action on the walls of the blood vessels leading to extensive bleeding in the tissues and (*e*) digestive action on the tissue due to ferments in the venom.

All these properties are not equally well developed in the venom of all snakes. Some of these toxic properties are more highly developed in the venom of some snakes, while others in the venom of other snakes. Of the Indian poisonous snakes the toxic action on the nervous system is most highly developed in the case of the Cobra, while the action on the circulatory system is most marked in the venom of the Russell's Viper. He then described the train of symptoms which result in human beings after a snake bites.

Next he took up the question of medicinal uses of venoms. Cobra venom has proved to be of some value in relieving pain in inoperable cancer. The hope that this venom would inhibit the growth of cancer has not been fulfilled. The venom of Russell's Viper is a very powerful agent in stopping intractable bleeding. It has proved of great value in stopping bleeding in cases of haemophilia and in case of operations on tonsils and teeth extraction. Scientific investigation has not supported the claim that snake venom is of any value in the treatment of epilepsy.

THE CHILDREN OF THE JUNGLE.

Mr. S. Jepson showed his film depicting the life and customs of Bhils, Gonds and other jungle tribes.

In a few introductory remarks Mr. Jepson explained that the film was a self-imposed holiday task shot in a fortnight in the jungle, though it took much longer to prepare and to edit afterwards. There were many amusing moments with these original actors and actresses—including the selection of a bride for the wedding ceremony. The film was a documentary one, half dealing with the lives of Bhils and other forest tribes showing how they could be independent of cultivation, etc. The other half dealt with very amusing Bhil wedding customs. On returning to Bombay and after editing, the film had a running commentary superimposed on the sound track, in a local studio.

'As you will presently observe for yourself,' said Mr. Jepson humorously, 'I know nothing whatever about film making, and the whole thing was in the nature of an experiment.'

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VEPERY, MADRAS, FOR THE BOMBAY NATURAL HISTORY SOCIETY, BOMBAY

BOMBAY NATURAL HISTORY SOCIETY.

BALANCE SHEET AS AT 31st DECEMBER 1936.

LIABILITIES	Rs A P	Rs A P
Life Membership fees:		49,875 0 0
Donations for specific objects unexpended:		
Show Cases, Models of Fish, etc. in Prince of Wales Museum—Account No. 1 ...	1,362 4 7	
Show Cases, etc. in New Building, in Prince of Wales Museum—No. 2. ...	3,821 1 11	
Special Journal Fund	11,089 8 6	16,272 15 0
Sundry Creditors:		
Printers of Journals	2,292 10 8	
,, of Beautiful Indian Trees ...	27 5 4	
,, of Bale Sons and Danielsson Ltd., London, Account ...		
,, of Game Book, Vol. I and II ...	27 10 8	
For Expenses	250 0 0	2,597 10 8
Surplus Assets:		
Balance as per last Balance Sheet ...	31,541 13 2	
Less.—Libel Case... ... Rs 2,259 A 12 P 1 Loss on Revenue Account. 835 10 5	3,095 6 6	28,446 6 8
Total ...		97,192 0 4

ASSETS	Rs A P	Rs A P
Investments—At holding value or Market value on 31st December, 1936, whichever is lower:—		
Rs. 35,000 3½% Loan 1947/50 at 102¼% ...	35,787 8 0	
,, 15,000 5% do. 1945-55 at par ...	15,000 0 0	
,, 10,000 3% do. 1951-54 at 98% ...	9,800 0 0	
,, 14,000 4% Port Trust Bonds at 77%...	10,780 0 0	
,, 15,000 4 % Improvement Trust Bonds at 76%...	11,400 0 0	
Rs. 89,000		82,767 8 0
Cash—		
With National Bank of India, Ltd., Bombay	7,105 11 5	
With National Bank of India, Ltd., London, £60-2-10 at 1/6	801 14 3	
On hand	150 0 0	8,057 9 8
Sundry Debtors:		2,029 11 0
Advances to Staff:		373 0 0
Furniture:		
As per last Balance Sheet	1,602 0 0	
Less Depreciation	25 0 0	1,577 0 0
Publications, excluding Journals: Stock on hand as certified by the Hon. Secretary		300 0 0
Game Books, Vol. III: Stock on hand as certified by the Hon. Secretary		536 12 1
Beautiful Indian Trees: Stock on hand as certified by the Hon. Secretary		1,550 7 7
Total ...		97,192 0 4

Note.—A stock of 20,100 old Journals and the valuable research collection and Library of 2,600 volumes have not been taken into account on the asset side of the Balance Sheet.

We have prepared the above Balance Sheet from the Cash Book and from the information given to us, and have verified the Investments.

In our opinion such Balance Sheet represents a true and correct view of the state of the Society's affairs according to the best of our information and the explanations given to us.

(Sd.) A. F. FERGUSON & CO.,
Chartered Accountants, Auditors.

H. M. McGUSTY,
Honorary Treasurer.

BOMBAY NATURAL HISTORY SOCIETY.

REVENUE ACCOUNT FOR THE YEAR ENDED 31st DECEMBER, 1936.

Dr.

	Rs	A	P	Rs	A	P
To Salaries	18,225	12	0			
,, Society's Contribution to Staff Provident Fund	1,468	8	8			
,, General charges	294	11	4			
,, Rent	2,436	0	0			
,, Stationery and Printing	241	7	6			
,, Postage	753	3	0			
,, Library	338	4	10			
,, Audit Fee	250	0	0			
,, Fire Insurance	100	0	0			
,, Depreciation on Furniture	25	0	0			
,, Loss on Capt. Bate's '*Bird Life*' ...	478	8	6			
,, Cost of Printing Journals	6,455	1	10			
				31,066	9	8
Total ...				31,066	9	8

Cr.

	Rs	A	P	Rs	A	P
By Subscriptions	22,006	7	8			
,, Entrance Fees	580	0	0			
,, *Sales of :*						
Journals	1,209	5	5			
Game Books, Vols. I & II	847	0	11			
Bird Charts and Albums	472	9	9			
Butterfly Books	126	7	2			
Society's Small Publications	623	5	2			
,, Interest on Investments	3,419	12	0			
,, Taxidermy Department	239	0	8			
,, Recoverable Charges	706	14	6			
				30,230	15	3
,, Balance of Expenditure over Income ...				835	10	5
Total ...				31,066	9	8

PUBLICATION ACCOUNT FOR THE YEAR ENDED 31st DECEMBER, 1936.

	Rs	A	P	Rs	A	P
To Stock of Game Books, Vol. III	705	9	0			
,, Expenses during the year	43	3	1			
				748	12	1
,, Stock of Beautiful Indian Trees ...	1,514	6	3			
,, Expenses during the year	36	1	4			
				1,550	7	7

	Rs	A	P	Rs	A	P
By Sales of Game Book, Vol. III	212	0	0			
,, Stock on hand (31st December, 1936) ...	536	12	1			
				748	12	1
,, Beautiful Indian Trees Stock on hand (31st December, 1936)	......			1,550	7	7

Dr. **Cr.**

INCOME AND EXPENDITURE ACCOUNT OF DONATIONS FOR SPECIFIC PURPOSES FOR THE YEAR ENDED 31st DECEMBER, 1936.

	Rs A P	Rs A P		Rs A P	Rs A P
Fund No. 1					
To Expenditure on Fish Gallery etc. ...	2,250 11 3		By Unexpended Balance as per last Balance Sheet	1,412 15 10	
,, Balance carried to Balance Sheet ...	1,362 4 7	3,612 15 10	,, Donations for the Modeller's Salary etc.	2,200 0 0	3,612 15 10
Show Cases Fund No. 2					
,, Expenditure on Show Cases in New Building	20,143 10 1		,, Unexpended Balance for Show Cases in New Building as per last Balance Sheet	18,932 11 0	
,, Balance carried to Balance Sheet ...	3,821 1 11	23,964 12 0	,, Interest	532 1 0	
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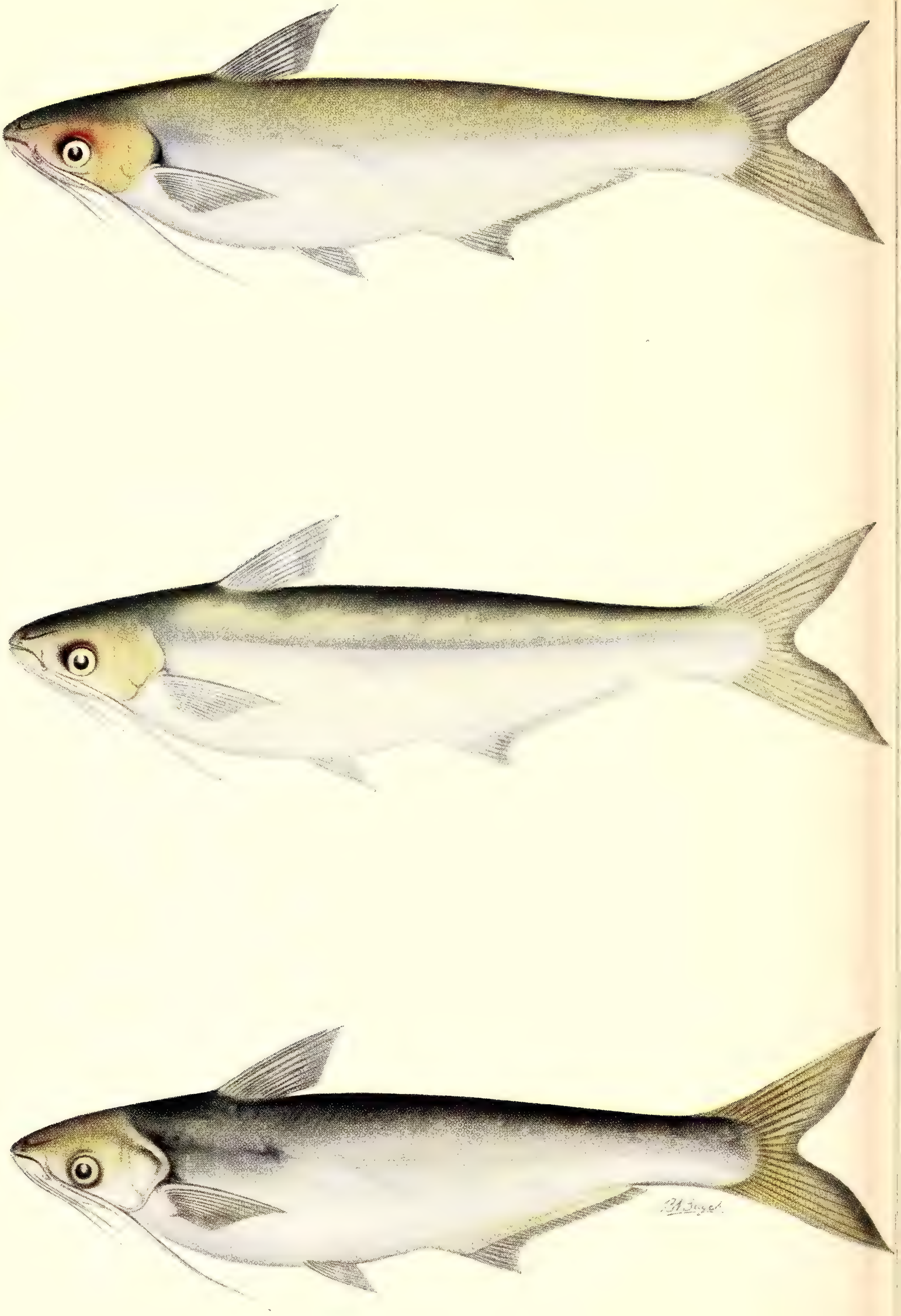

THE GARUA BĀCHCHĀ OR GAURCHCHĀ.
Clupisoma garua (Hamilton).

JOURNAL
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DECEMBER 1937. VOL. XXXIX. NO. 4

THE GAME FISHES OF INDIA[1].

BY

SUNDER LAL HORA, D.SC., F.R.S.E., F.L.S., F.Z.S., F.R.A.S.B., F.N.I.,

Assistant Superintendent, Zoological Survey of India, Calcutta.

(*With one plate and nine text-figures*).

Continued from page 446 *of* Vol. xxxix.

III.—'GARUA BĀCHCHĀ OR GAURCHCHĀ'.

CLUPISOMA GARUA (HAMILTON) and two allied species.

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INTRODUCTION.

In the last article (**21**)[2] reference was made to the fact that among anglers two Indian catfishes go by the name of *Bāchchā*—*Eutropiichthys vacha* (Ham.) and *Clupisoma garua* (Ham.). Both the forms belong to the family *Schilbeidae* and are superficially very much alike. In my treatment of the true *Bāchchā*, I gave the distinguishing features of the two species and a reference was made to their habits and habitats. In the present article it is proposed to give a full scientific account of *Garua Bāchchā* or *Gaurchchā* and of its allied forms.

---

[1] Published with permission of the Director, Zoological Survey of India.

[2] Numerals in thick type within brackets refer to the serial numbers of the various publications listed in the bibliography at the end of the paper.

In the case of *E. vacha* it was shown that specimens of the species from Siam and Burma differed from Indian examples in proportions, etc., to a marked degree, but for want of sufficient material it was not possible to separate them into a distinct species. Similar differences have been observed in the case of the Burmese examples of *Clupisoma garua* (Ham.) and besides it has been found that in the specimens from Burma the entire abdominal edge is sharp and keeled. It has, therefore, been considered advisable to separate them into a new species which is described below (*vide infra* p. 671). To create a new genus on the nature of the abdominal edge would have rather confused the true relationships of the two forms. In this connection attention may be directed to the fact that in the species of *Rohtee* Sykes two similar types of abdominal edges are found (**14**), and it is remarkable that *R. belangeri* (Cuv. & Val.), in which the abdominal edge is keeled throughout, is essentially a Burmese species. Further it may also be noted that a species of *Pangasius* from Siam, *P. cultratus* Smith, is provided with 'a fleshy keel on the belly, extending from below the pectorals to the vent'. Fowler (**11**) has established a new genus *Pteropangasius* for its reception on this character alone. In all the three instances noted above it is remarkable that the forms with the keeled abdomen are found towards the east whence, according to my belief, the aquatic fauna migrated and spread towards the west (**19**). Further the keeled condition of the abdomen is probably a primitive feature, in so far as it is characteristic of the majority of the Isospondylous fishes and of the primitive Cyprinoids (subfamily: Abramidinae).

In the Eastern Himalayas, Messrs. G. E. Shaw and E. O. Shebbeare found another species in which the abdominal edge is rounded throughout, the barbels are considerably shorter, the air-bladder is greatly reduced, and there are certain differences in proportions from *C. garua* and the form found in Burma. Here again, though according to some authorities it may be desirable to separate it into a new genus I have considered it advisable for the time being, in view of the paucity of the material and of our very limited knowledge of these forms, to retain it in the genus *Clupisoma* and to describe it as a new species (*vide infra,* p. 673). Thus the three species here included in *Clupisoma* represent three very distinct types and in my opinion form an evolutionary series in which the Burmese form is probably the most primitive and the Eastern Himalayan form the most highly specialised in certain respects, and primitive in certain other respects.

As the colouration undergoes rapid changes when a fish is taken out of water, it is usually difficult to form a correct idea of the natural colours of large fishes; the so-called coloured drawings of such species can at best represent the colours of fresh specimens. My drawings of the 'Indian Trout' (*Barilius bola* Ham. **20**) and of *Vacha* [*Eutropiichthys vacha* (Ham.) **21**] are no exception in this respect. In the drawings of *Garua Bāchchā* reproduced here an attempt has been made to show the changes in colouration undergone by the fish when taken out of water. The topmost drawing represents the colouration of the specimen immediately after its removal from water, the middle figure shows the fish after it had been out of water for about one hour and the bottom figure shows the colour after about two hours of the removal of the fish from the water. Gradually a uniform neutral tint begins to predominate and the colour becomes similar to that shown in my drawing of *Eutropiichthys vacha* (**21**). For all practical purposes, anglers are concerned with the colouration of the fresh specimens and not of the living fish and from this point of view the illustrations already reproduced or to be reproduced in connection with the articles to follow will be found useful. Efforts will, however, be made to describe the colouration of living specimens wherever possible. It may further be indicated that colour is liable to change with the surroundings, so in the case of fishes, at any rate, it does not form a reliable character for distinguishing species.

Nomenclature and Systematic Position.

The *Garua Bāchchā* or *Gaurchchā* was discovered for science by Hamilton (**13**), who named it *Silurus garua*. His interpretation of the genus *Silurus* Linn. seems to have been very vague, as, according to the modern standards, none of his species of *Silurus* is now referred to that genus. In Indian waters there are only two species of *Silurus* (**17**), *S. wynaadensis* Day and *S. cochinchinensis* Cuv. & Val. The following table shows the present-day systematic position of Hamilton's species of *Silurus*:—

Genus *Heteropneustes* Müller (**16**).
1. *Silurus singio* Hamilton [=*Heteropneustes fossilis* (Bl.)].

Genus *Callichrous* Hamilton (**18**).
2. *Silurus pabda* Hamilton [=*Callichrous bimaculatus* (Bl.)].
3. *Silurus canio* Hamilton [=*Callichrous bimaculatus* (Bl.)].
4. *Silurus duda* Hamilton [=*Callichrous bimaculatus* (Bl.)].
5. *Silurus chechra* Hamilton [=*Callichrous bimaculatus* (Bl.)].
6. *Silurus pabo* Hamilton (*Callichrous pabo* Ham.).

Genus *Wallago* Bleeker (**15**).
7. *Silurus boalis* Hamilton. [=*Wallago attu* (Bl.)].

Genus *Clupisoma* Swainson (**22**).
8. *Silurus garua* Hamilton. [*Clupisoma garua* (Ham.)].

In the first seven species, the dorsal fin is not provided with a bony, pungent spine and in this respect they agree with the typical members of the genus *Silurus*. In Hamilton's *S. garua* the first ray of the back fin 'is a prickle, indented behind, and terminated by a substance like whale bone' (**13**, p. 187). On this character, among others, *Gaurchchā* is to be regarded a member of the same family, *Schilbeidae*, as the true *vacha* described in the earlier article (**21**).

Swainson (**22**) was the first to separate *Garua* from Hamilton's other allied species and constitute for it a separate genus *Clupisoma* which he defined as follows:—

> 'Herring-shaped; head and body compressed, of nearly equal breadth; eyes very large; teeth in both jaws and on the palate granulated and crowded; caudal fin large, forked; dorsal fin placed almost above the pectoral; vent nearly central.'

Swainson had no specimen of the species for examination but based his diagnosis of *Clupisoma* on Hamilton's description and figures of *Silurus garua*. At the same time, he proposed a new specific name—*argentata*—for this species. Cuvier and Valenciennes (**6**), Bleeker (**1**) and Blyth (**4**), however, assigned Hamilton's species to *Schilbe* Cuvier, an African genus closely allied to the Indian representatives of the family *Schilbeidae*. In the African genera of the family, however, the two pairs of mandibular barbels are situated at different levels, while in the Indian fishes they are placed in a single row. In 1858, Bleeker (**2**) separated the Indian species generically from the allied African forms and placed Hamilton's *Silurus garua* into a new genus, *Schilbeichthys*, which was briefly characterised as follows:—

> 'Pinna dorsalis hymenophora sinifera. Cirri 8. Dentes vomero-palatini in thurmus 4 dispositi.'

At the time of creating this genus Bleeker seems to have been aware of Swainson's *Clupisoma*, for he included *C. argentata* Swainson under the synonymy of his *Schilbeichthys garua*. Later, Bleeker (**3**) recognised Swainson's genus and merged his *Schilbeichthys* into its synonymy. The genus was included in the family *Siluriformes* and defined as:

> 'Dentes vomero-palatini in vittam quadripartitam dispositi. Nares magnae patulae approximatae, anteriores non tubulatae. Maxilla inferior superiore brevior. B.7. D.1/7. P. 1/11. V.1/5.'

Evidently not being aware of *Clupisoma* Swainson, Günther (**12**) adopted the generic name *Schilbeichthys* and emended its definition as follows:

> 'One short dorsal fin with a pungent spine; no adipose fin; the anal fin terminates at some distance from the caudal, which is forked. Barbels eight, as in *Ailia*. Vomerine and palatine teeth present. Nostrils close together, at the end of the snout, very wide, the posterior twice as wide as the anterior. Head covered with skin. The upper profile is nearly straight; neck not elevated; upper jaw longer than the lower; orbit with a broad anterior and posterior adipose eyelid, behind the cleft of the mouth. Ventral composed of six rays.'

Only one species—*Sch. garua*—was included by Günther in this genus.

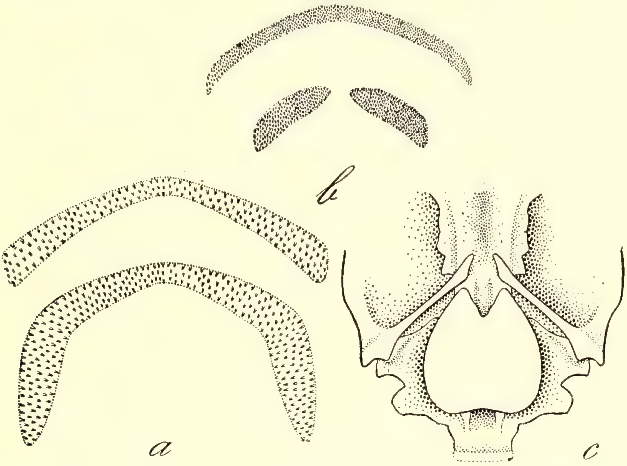
Day (**7**) disagreed with all previous workers and assigned Hamilton's *garua* to *Pseudeutropius* Bleeker. In doing so he remarked:

> 'This species forms the type of the genus *Schilbeichthys*, Bleeker, which differs from the *Pseudeutropius* chiefly in having no second or adipose dorsal fin.
>
> 'I have taken a large number of the young of this species from 4 to 9 inches in length, and find that the adipose dorsal, though small, is distinct in the fry; but as the size of the specimens increases up to 6 or 7 inches it has either almost or entirely disappeared, and is invariably absent in the adult.

> 'I therefore consider the species to be a *Pseudeutropius;* for the difference which exists in the nostrils between it and some others of the genus is insufficient for more than a specific division.'

The above case for the inclusion of Hamilton's *Silurus garua* in *Pseudeutropius* is not based on any sound reasoning as will be shown in a subsequent communication elsewhere. It is, however, true that the adipose fin is present in the fry of *garua* and is gradually absorbed as the fish grows older. In his original diagnosis of *Schilbeichthys* (*vide supra,* p. 662), Bleeker referred to dentition as the most important character for the definition of his genus, but later he took into consideration the character of the nostrils also. These features, coupled with the herring-like form of the fish and the peculiar form and structure of the air-bladder, are sufficiently distinctive to separate Hamilton's *garua* generically from the allied forms included by Day under *Pseudeutropius* Bleeker. It may here be mentioned that Day's *Pseudeutropius* is a composite genus.

In *Clupisoma garua,* as a rule, the vomero-palatine teeth form a broad, semilunar band (text-fig. 1*a*) which may sometimes be interrupted in the middle. There is a specimen in the Indian Museum from Assam (No. 468; text-fig. 1*b*) in which the dentition is abnormal; the vomero-palatine bands are interrupted in the middle and lie obliquely across the palate. The palatine teeth are not produced backwards to form a semilunar band, as is usually the case in this species.



Text-fig. 1.—Upper dentition and air-bladder of *Clupisoma garua* (Ham.).

a. Normal dentition of a specimen, 246 mm. in length without caudal. $\times 2\frac{2}{3}$; *b.* Abnormal dentition of the specimen No. 468, 126 mm. in length without caudal. $\times 4\frac{2}{3}$; *c.* Air-bladder of a young specimen, 95 mm. in length without caudal. $\times 3\frac{2}{3}$.

The structure of the air-bladder was at first described by Day (8) who stated that:

> 'Air-vessel in *P. garua,* H. B., small and somewhat heart-shaped, it is closely attached to the bodies of the anterior vertebrae; its external fibrous

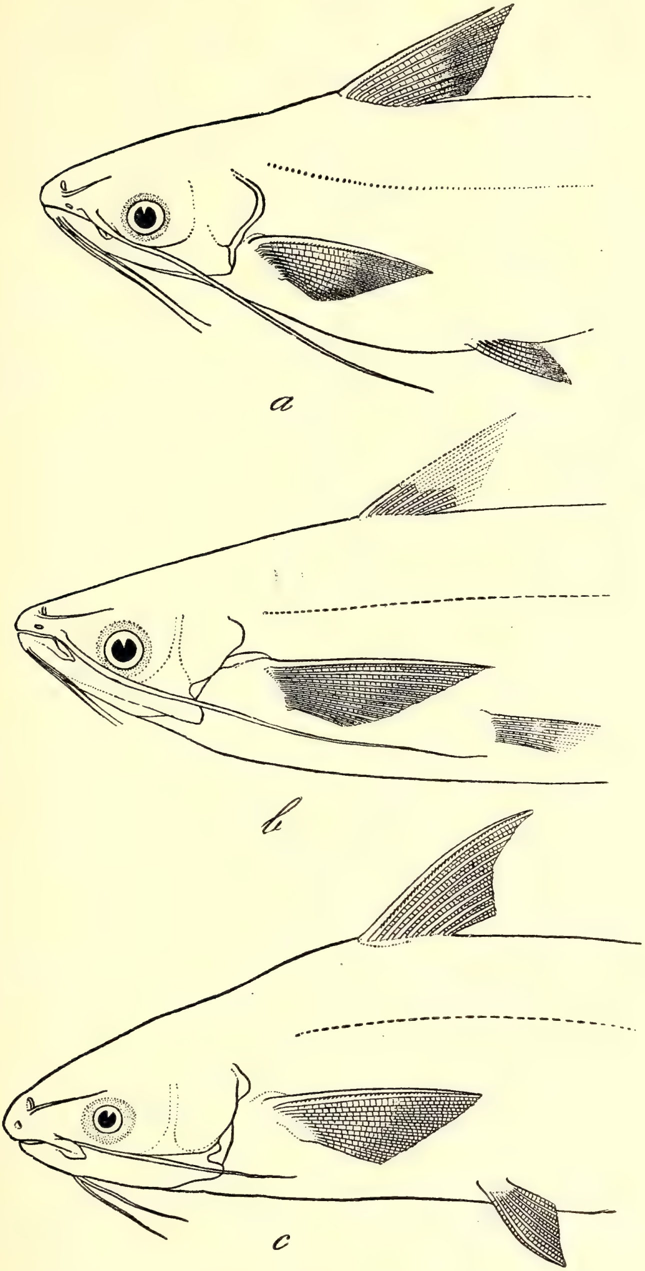
covering is of moderate length . . . *P. garua*, in which the adipose dorsal is so small, and altogether absorbed in the adult, has the smallest air-vessel amongst the larger species which I have examined.'

Bridge and Haddon (**5**) have, however, described the structure in much greater detail and I have figured it here (text-fig. 1*c*) to show its form in a young specimen 95 mm. in length without the caudal. With growth the bladder becomes more solid and is still further reduced, but its form remains more or less the same.

In the other two species similar variations of the tooth-bands and of the air-bladder are found. These are discussed below under the accounts of the new species.

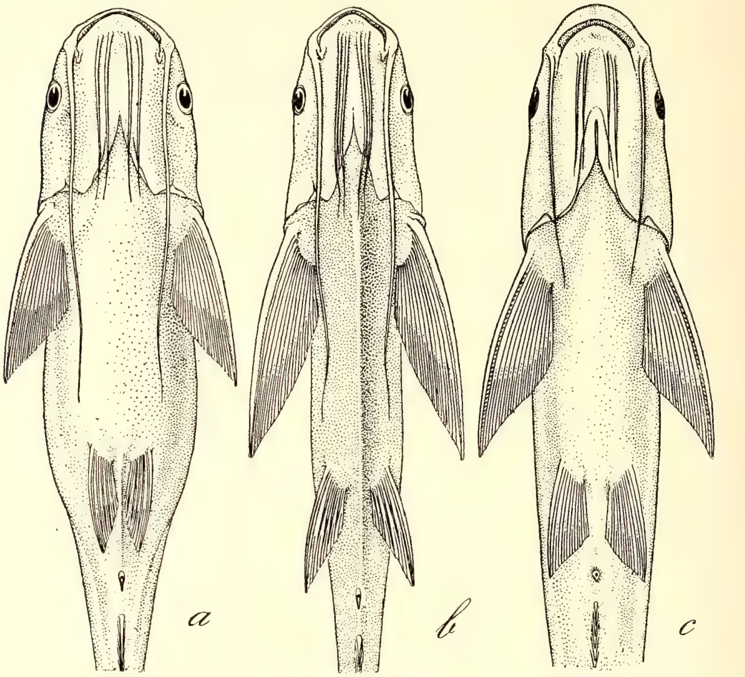
From the above it is clear that the chief diagnostic features of the genus *Clupisoma* are (i) the form of the body, (ii) the nature of the tooth-bands, (iii) the form and nature of the air-bladder and (iv) the large size of the posterior nostrils. The genus may now be redefined as follows:—

The body is elongated and compressed; it is almost herring-shaped. The whole of the abdominal edge or the part between the pelvic fins and the vent may be keeled. The head and body are covered with soft skin. The head is oval, blunt and of moderate size. A median fontanel on head extends between the eyes to the nostrils. The occipital process is narrow and long; it extends almost to the basal bone of the dorsal fin. The eyes are large, ventro-lateral in position and provided with broad adipose lids; these lids are better developed along the anterior and posterior borders of the eye. The eyes are situated behind the cleft of the mouth. The mouth is subterminal, transverse and of moderate width; it is slightly overhung by the snout. The nostrils are very prominent and are not situated very far apart. The anterior nostrils are oval and are placed along the front border of the snout. The posterior nostrils are represented by wide, transverse slits on the top of the head. There are eight barbels, one pair nasal, one pair maxillary with anterior ends situated in grooves below the eyes and two pairs mandibular with their bases not very far from the tip of the lower jaw and forming a straight line. The teeth are small and villiform; they form bands in the jaws which are not produced at the sides. The vomerine and palatine teeth are contiguous, forming either a transverse or a semilunar band across the palate. The tooth-bands on the palate are subject to considerable variations. The dorsal fin is situated considerably in advance of the ventrals; it is provided with a spine of moderate strength which is finely serrated or roughened internally. A small adipose dorsal may be present or absent. The pectoral spine may be strong, roughened externally and serrated internally, or it may be soft and finely pectinated internally. The pelvics have six rays each. The anal fin is long. The caudal fin is deeply forked. The gill-openings are wide. The gill-membranes are deeply notched; they are united with each other but are free from the isthmus. The air-bladder is greatly reduced, thick-walled and flattened; it is closely applied to the ventral surface of the anterior vertebrae.



Text-fig. 2.—Lateral view of head and anterior part of body of the three species of *Clupisoma* Swainson.

a. *Clupisoma garua* (Ham.). $\times\frac{2}{3}$. Length of specimen 212 mm. without caudal; *b*. *Clupisoma prateri*, sp. nov. $\times\frac{2}{3}$. Length of specimen 240 mm. without caudal; *c*. *Clupisoma montana*, sp. nov. $\times\frac{2}{3}$. Length of specimen 241 mm. without caudal.



Text-fig. 3.—Ventral surface of head and anterior part of body of three species of *Clupisoma* Swainson.

a. *Clupisoma garua* (Ham.). $\times \frac{2}{3}$. Length of specimen 212 mm. without caudal; *b.* *Clupisoma prateri*, sp. nov. $\times \frac{2}{3}$. Length of specimen 240 mm. without caudal; *c.* *Clupisoma montana*, sp. nov. $\times \frac{2}{3}$. Length of specimen 241 mm. without caudal.

The three species of *Clupisoma*, referred to above, may be distinguished by the following key:—

A. Nasal barbels not extending to front margin of eye (text-fig. 2*a*); abdominal edge keeled between pelvics and vent (text-fig. 3*a*); pectorals not extending to pelvics (text-figs. 2*a* and 3*a*) ... ... *C. garua* (Ham.).

B. Nasal barbels extending considerably beyond front border of eye (text-figs. 2*b* and *c*); pectorals reaching base of pelvics (text-figs. 2*b*, 2*c*; 3*b*, 3*c*).

  I. Abdominal edge keeled throughout (text-fig. 3*b*); maxillary barbels extending beyond middle of pectorals; mandibular barbels extending to posterior margin of operculum ... ... *C. prateri*, sp. nov.

  II. Abdominal edge rounded (text-fig. 3*c*); maxillary barbels not extending beyond base of pectorals; mandibular barbels not extending to posterior margin of operculum ... ... *C. montana*, sp. nov.

Synonymy and Description.

Clupisoma garua (Hamilton).

1822. *Silurus garua*, Hamilton, *Fish. Ganges*, pp. 156, 375, pl. xxi, fig. 50.
1839. *Clupisoma argentata*, Swainson, *Nat. Hist. Fish.* etc., ii, p. 306.
1839. *Schilbe garua*, Cuvier & Valenciennes, *Hist. Nat. Poiss.*, xiv, p. 379, pl. ccccxiii.

1853. *Schilbe garua*, Bleeker, *Verh. Bat. Gen.*, xxv, pp. 54, 110.
1858. *Schilbe garua*, Blyth, *Proc. As. Soc. Bengal*, p. 283.
1858. *Schilbeichthys garua*, Bleeker, *Ichth. Arch. Ind. Prod.*, i, Siluri, p. 256.
1862. *Clupisoma garua*, Bleeker, *Versl. Akad. Amsterdam*, xiv, p. 393.
1863. *Clupisoma garua*, Bleeker, *Ned. Tijdschr. Dierk.*, i, p. 114.
1864. *Schilbeichthys garua*, Günther, *Cat. Fish. Brit. Mus.*, v, p. 57.
1869. *Pseudeutropius garua*, Day, *Proc. Zool. Soc. London*, p. 307.
1871. *Pseudeutropius garua*, Day, *Proc. Zool. Soc. London*, p. 709 (Air-bladder).
1873. *Pseudeutropius garua*, Day, *Rep. Freshw. Fish. Fisheries India & Burma*, p. 265.
1877. *Schilbeichthys garua*, Beavan, *Freshw. Fish. India*, p. 134.
1877. *Pseudeutropius garua*, Day (in part), *Fish. India*, p. 474, pl. cix, fig. 6.
1889. *Pseudeutropius garua*, Day (in part), *Faun. Brit. India Fish.*, i, p. 141.
1894. *Schilbeichthys garua*, Bridge & Haddon, *Phil. Trans. Roy. Soc. London* (B), clxxxiv, pp. 211-213 (Air-bladder and Weberian Ossicles).
1913. *Pseudeutropius garua*, Chaudhuri, *Rec. Ind. Mus.*, viii, p. 255.
1937. *Clupisoma garua*, Hora, *Proc. Nat. Inst. Sci. Ind.*, iii, p. 39 (disposition of liver and kidney).

Vernacular Names:—*Garua*, *Gharuya* and *Gaurchchā* (Calcutta, Lakshmipur and Goalpara); *Kocha* (Tista); *Punia Cathua* (Ooriah); *Puttosi* (Bengal); *Buchua* (Hind.); *Dhon-ga-nu* (Sind); *Buchua*, *Chel-lee* and *Ka-raad* (Punjab); *Bikree* (Oudh).

Clupisoma garua is a herring-shaped fish, tapering very gradually toward both ends. The head is oval, blunt, and of moderate size; it is somewhat wider than the body. The length of the head is contained from 4.8 to 5.6 times in the length without the caudal; its height at the occiput is almost equal to its greatest width and is contained from 1.2 to 1.6 times in its length. The head is proportionately longer and narrower in young specimens. The eyes are large, ventro-lateral in position and situated almost in the middle of the head. The longest axis of the pupil is vertical. The diameter of the eye is contained from 3 to 3.8 times in the length of the head; from 1.2 to 1.6 times in the length of the snout and from 1.1 to 1.8 times in the interorbital width. The head is provided with a median fontanel between the eyes which extends to the nostrils. The occipital process is long and pointed; it is nearly 4 times as long as wide and sometimes extends to the basal bone of the dorsal fin. There are four pairs of barbels; the nasal barbels usually do not extend as far as the anterior border of the eye, the maxillary barbels reach to the base of the pelvics, and the mandibular barbels to the base of the pectorals. In younger specimens the barbels are proportionately longer. The nostrils are very prominent; the posterior nostrils are large oval slits, sometimes three times as broad as the anterior nostrils. The mouth is fairly wide and almost anterior; the snout projects beyond the lower jaw only slightly. The teeth are small and villiform; those on the palate are arranged in a semicircle. Sometimes the vomero-palatine band is indistinctly divided into four patches and very rarely the teeth on the palate are arranged in two short bands disposed in a transverse row.

The dorsal fin is wholly in advance of the ventrals; its spine is rather slender, rugose anteriorly and feebly serrated posteriorly;

it is almost as long as the head behind the nostrils. The adipose dorsal is always absent in the adult, but in young specimens up to about 100 mm. in length it is present as a minute structure. The pectoral spine is somewhat longer and stronger than that of the dorsal fin; it does not extend to the base of the pelvic fins; it is roughened externally but denticulated internally. The ventral fins are situated slightly dorsal to the ventral profile of the body. The abdominal edge between the pelvics and the vent is keeled. The caudal fin is deeply forked; the lower lobe is longer than the upper.

The depth of the body is contained from 4.6 to 5.6 times in the length without the caudal. The head is somewhat broader than the width of the body.

According to Hamilton (**13**), 'The prevailing colour is silver, with green on the back. The fins are diaphanous, that on the back and the pectorals being dotted and that of the tail being edged with black. The head and shoulders have a golden gloss.'

During the fishing of a large settling tank at the Calcutta Corporation's Water-works at Pulta during August 1937, several specimens of *Clupisoma garua* were obtained. As there was an artist with me, he very kindly noted the changes in colouration and the three illustrations in the colour plate show this point very clearly. When the fish is just taken out of water the dorsal surface is yellowish apple-green and the upper surface of the head is French-green. The side of the head is light orange-buff with a streak of coral red above the eyes. The sides of the body are silvery showing metallic hues. The fins are mostly diaphanous, but the caudal fin is light yellow in colour with a margin of light neutral tint. About an hour afterwards, the colour along the dorsal surface became French-green and the original yellow was still present in a broad, lateral patch one along each side. The side of the head changed to yellow ochre and the streak above the eye to madder-brown. The marking of the caudal fin became somewhat deeper. After about 2 hours the colour changed to a neutral tint and the caudal fin became distinctly yellow. The head developed light neutral tint and with a considerable proportion of the yellow colour. The base of the anal fin turned light lemon-yellow. The caudal fin became raw sienna and its margin turned still deeper. Finally the colour of the fish changed to a silvery neutral tint, just as was figured in the case of *Eutropiichthys vacha* (Ham.) in the second article of this series.

Distribution:—The material of *C. garua* in the collection of the Indian Museum is not sufficient to discuss its distribution. Day (**10**) stated that the fish is 'Found generally throughout the larger rivers of Sind, India, Assam and Burma'. The Burmese specimens represent a distinct species. It seems probable that the fish does not occur in the Deccan as I have not found any record of the species from that area. Though I recently collected a considerable amount of material from the Hooghly river above Calcutta, there are not many specimens from other localities in India for study. Consequently it is not possible to give an account of the probable variations undergone by the species.

Measurements in millimetres.

	C. P.	Sara Ghat, Bengal	Saran, Bihar	Shantipur, Hooghli River.	Orissa	Shantipur, Hooghli River.	Assam	Calcutta, Hooghli River.	Kanchara-para, Hooghli River.
Total length excluding caudal ...	96·0	97·0	130·0	132·0	166·0	198·0	220·0	273·0	276·0
Length of head	20·0	20·0	25·3	25·0	33·5	35·0	43·0	51·0	53·0
Width of head	12·0	12·5	16·0	17·0	23·0	25·0	29·0	38·0	41·0
Height of head at occiput ...	12·0	12·5	16·0	18·0	23·0	27·0	33·0	38·0	42·0
Width of body	9·0	11·5	13·5	15·0	16·0	22·0	25·0	28·0	32·0
Height of body	18·5	18·0	25·0	25·0	33·0	40·0	47·0	48·0	59·0
Diameter of eye	6·0	6·5	8·0	8·0	10·0	11·0	13·0	16·0	14·0
Length of snout	7·0	8·0	10·0	10·5	13·0	15·0	16·0	20·0	21·0
Interorbital width	7·0	8·0	11·0	12·0	16·0	18·5	19·0	24·0	26·0
Length of pectoral spine ...	14·0	15·0	24·5	23·0	33·0	34·5	39·0	50·0	51·0
Length of dorsal spine	13·0	...	...	21·0	29·0	30·0	37·0	41·0	46·0
Length of nasal barbel	6·5	4·0	4·5	6·0	7·0	6·0	11·0	11·0	10·0
Length of maxillary barbel ...	33·0	46·0	55·5	55·0	69·0	68·0	77·0	107·0	96·0
Length of outer mandibular barbel.	17·0	15·0	23·0	20·0	30·0	25·0	39·0	43·0	38·0
Length of inner mandibular barbel.	19·0	19·0	24·0	24·0	26·0	28·5	42·0	44·0	45·0
Least height of caudal peduncle ...	8·0	8·0	11·0	13·0	16·0	16·0	19·0	24·0	27·5
Commencement of dorsal from tip of snout	30·0	31·0	39·0	40·0	55·0	60·0	67·0	82·0	85·0

Bionomics and Fishing Notes.

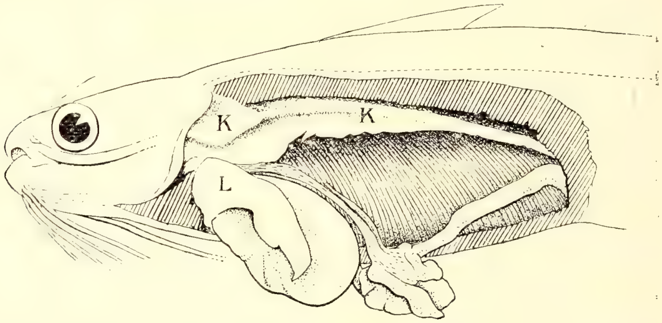
In his list of the fishes of the Rangpur District Hamilton (*vide* Day, **9**) made the following observation under *Gharaya*:

> 'This is a very common fish, but is not eaten by the higher classes, because it is supposed to feed on excrement. It grows to three feet in length, and although its colours are green and silver, has a very lurid ugly appearance.'

In his (**13**) 'Gangetic Fishes', however, he states:

> 'The *Garua* is common in the fresh water rivers of the Gangetic provinces, often grows to two feet in length, and by the natives is considered as good eating. It has little or none of that lurid appearance to which many kindred fishes are liable.'

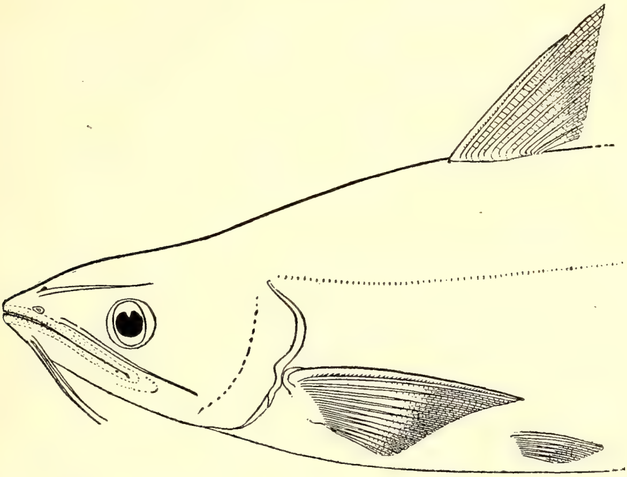
So far as my experience is concerned *Garua Bāchchā* is considered good eating throughout its range. In the Punjab *Bāchchā* is considered a great delicacy by the Indians and Europeans alike and fetches a somewhat higher price. In the course of my recent survey of the Hooghli river above Calcutta I found that both *Eutropiichthys vacha* and *Clupisoma garua* were sold everywhere at a somewhat higher price than the other species of fish.



Text-fig. 4.—Dissection of the visceral organs of *Clupisoma garua* (Ham.), to show the nature of the alimentary canal and the disposition of the liver (L) and the kidney (K). ×1⅓. Reproduced from *Proc. Nat. Inst. Sci. India*, vol. iii, p. 39, 1937).

An examination of the stomach contents of a number of large specimens, over a foot in length, obtained from the Calcutta Corporation's Water-works at Pulta on the 14th August, 1937, showed that the fish feeds on crabs, shrimps, fish, insects, etc. A certain amount of vegetable matter was also found in the stomach of some specimens. The alimentary canal is one and a half times as long as the entire length of the fish and this clearly shows that, as compared with *Eutropiichthys vacha*, it is probably not a very clean feeder. The stomach is in the form of a large bag devoid of any ridges along its walls. As I remarked in the earlier article, probably *Clupisoma* feeds at the bottom whereas *Eutropiichthys* chases its prey in mid-water or at the surface. The nature of the mouth opening in the two forms lends considerable support to such a view.

As anglers in writing their notes have hitherto made no distinction between *Eutropiichthys* and *Clupisoma* I have nothing further to add regarding the fishing of *Garua Bāchchā* beyond



Text-fig. 5.—Lateral view of head and anterior part of body of a specimen, 260 mm. long, of *Eutropiichthys vacha* (Ham.) from the river Hooghli. ×$\frac{3}{4}$.

what has already been given in my earlier account (**21**). It should, however, now be possible for anglers to make notes on the two species separately for the benefit of sportsmen in general.

DESCRIPTION OF TWO NEW SPECIES.

Clupisoma prateri, sp. nov.

1877. *Pseudeutropius garua*, Day (in part), *Fish. India*, p. 474.

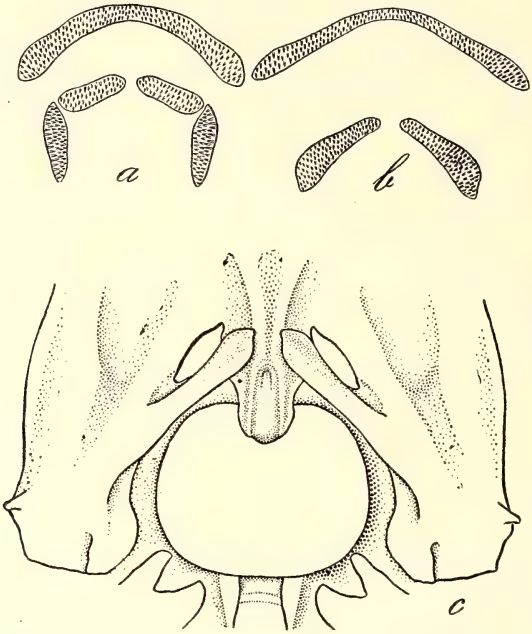
1885. *Pseudeutropius garua*, Vinciguerra (in part), *Ann. Mus. Civ. Stor. Nat. Genova* (2), ii, p. 91.

1889. *Pseudeutropius garua*, Day (in part), *Faun. Brit. Ind. Fish.*, i, p. 141.

1890. ? *Pseudeutropius garua*, Vinciguerra, *Ann. Mus. Civ. Stor. Nat. Genova* (2), ix, p. 209

Day (**10**) appears to be the first writer who extended the range of *Clupisoma garua* (Ham.) to Burma without making any comments. Vinciguerra (**23**) examined one specimen from Burma (Bassein) and one from Calcutta in 1885 and referred both of them to Hamilton's species without noting any points of difference between the two. Later, in his (**24**) more comprehensive work on the fishes of Burma, he found that his single specimen from Mandalay agreed with his previous example from Bassein and both of them differed from the Calcutta example. He mainly referred to the differences in the length of barbels, pectoral spine, anal fin and in the dentition and was doubtfully of the opinion that the specimens from Burma may not belong to Hamilton's species.

In the old collection of the Indian Museum there are several specimens from Burma referred by Day to *Clupisoma garua*. A careful examination of this material and its comparison with the typical examples from various parts of India have shown that Vinciguerra's doubts were justified. Though the Burmese examples are not in a very good state of preservation, their main features are so distinct from the Indian species that I have no hesitation in proposing for them a new species—*Clupisoma prateri*, and to associate it with the name of Mr. S. H. Prater in slight recognition of the valuable help he has rendered to me from time to time in procuring fresh material of Indian fishes for my studies.



Text-fig. 6.—Upper dentition and air-bladder of *Clupisoma prateri*. sp. nov. *a.* Upper dentition of specimen, No. 6048, 131 mm. in length without caudal. $\times 3\frac{1}{3}$; *b.* Upper dentition of type-specimen, Dup. Cat. No. 219, 212 mm. in length without caudal. $\times 3\frac{1}{3}$; *c.* Air-bladder and associated skeletal elements of the type-specimen. $\times 3\frac{1}{3}$.

The species will be described in detail when fresh material from Burma becomes available, but for the present I give below in a tabular form the main points of difference between *Clupisoma garua* (Ham.) and *Clupisoma prateri*, sp. nov.

Clupisoma prateri, sp. nov.	*Clupisoma garua* (Ham.).
1. Nasal barbels extend considerably beyond front margin of eye; sometimes even to the posterior border of eye.	Nasal barbels do not reach the eye.
2. Maxillary barbels extend to about the middle of pelvics, and sometimes to the commencement of the anal fin.	Maxillary barbels extend to base of pelvics, or in young to middle of pelvics.
3. Mandibular barbels extend to the hind border of operculum.	Mandibular barbels extend to the base of pectorals.

Clupisoma prateri, sp. nov.	*Clupisoma garua* (Ham.).
4. Pectorals extend considerably beyond the commencement of pelvics.	Pectorals do not extend to base of pelvics.
5. Anal with about 40 to 44 rays.	Anal with about 32 rays.
6. Whole of dorsal fin considerably in advance of the pelvics.	Whole of the dorsal fin just in advance of the pelvics.
7. Abdominal edge keeled throughout in front of vent.	Abdominal edge keeled between bases of pelvics and vent.

Besides the differences enumerated above between the two species, the relative proportions of the various parts also differ and these can be made out by a reference to the tables of measurements.

In the young specimens there is a small adipose fin, but it becomes wholly absorbed during growth. The dentition is more or less similar to that described above for *Clupisoma garua* and a similar type of abnormality is found in some of the specimens. Reference may here be made to the fact that in the specimen examined by Vinciguerra the vomero-palatine bands are short and are of the same nature as those illustrated here in text-figure 6*b*.

Locality: Burma.

Type-specimen: Duplicate Catalogue No. 213, *Zoological Survey of India, Calcutta.*

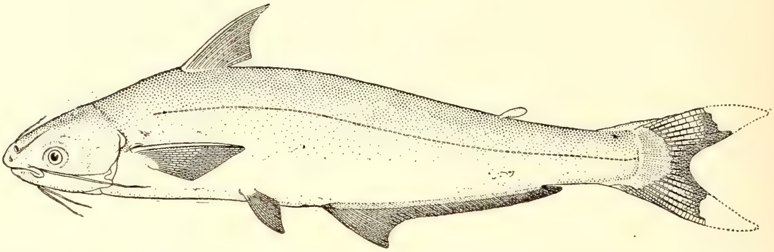
Measurements in millimetres.

	No. 8765	No. 8709	Dup. Cat. No. 219.
Total length excluding caudal ...	87·0	133·0	231·0
Length of head...	17·0	25·0	38·0
Width of head	11·0	15·5	23·5
Height of head at occiput... ...	11·5	17·0	28·0
Width of body	7·0	12·0	18·0
Height of body...	15·0	24·5	49·0
Diameter of eye	5·5	7·5	12·5
Length of snout	6·0	10·0	14·0
Interorbital width	8·0	11·0	15·0
Length of pectoral spine	19·0	29·0	50·0
Length of dorsal spine	14·0	...	...
Length of nasal barbel	8·0	12·5	13·5
Length of maxillary barbel ...	38·0	58·5	87·0
Length of outer mandibular barbel ...	18·0	22·0	31·0
Length of inner mandibular barbel ...	19·0	24·0	32·0
Least height of caudal peduncle ...	6·5	11·0	20·0
Commencement of dorsal from tip of snout	27·0	38·0	64·0

Clupisoma montana, sp. nov.

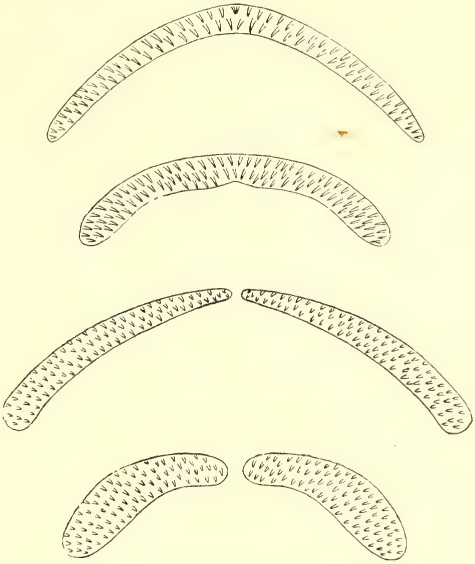
D. 1/6-7; A.41-43; P.1/12; V.6; C.17.

Clupisoma montana is a graceful species in which the head and body are moderately compressed and the body is relatively less deep. The dorsal profile is slightly arched, being highest near the commencement of the rayed dorsal. The head is short and bluntly pointed; its length is contained 5 times in the total length without the caudal. The width of the head is contained from 1.5 to 1.6 times and the height at occiput from 1.2 to 1.3 times in its length. In the middle of the dorsal surface of the head there is a narrow groove which commences between the nostrils and the eye and extends over the occipital process. The occipital process is long and narrow and almost meets the basal bone of the dorsal fin. The eyes are situated almost in the middle of the length of the head and are placed laterally above the angle of the mouth; they are provided with broad circular lids. The diameter of the eye is contained about 4.8 times in the length of head, 1.8 times in length of the snout and 2 times in the interorbital width. The interorbital space is distinctly convex. The mouth is inferior and obliquely directed upwards. The lips are thin and adhere closely to the jaws, except at the angles of the mouth where they form free lobes by their union. The lower jaw is somewhat sharp and broadly pointed. The teeth are small and villiform; those of the jaws form narrow bands which may be interrupted in the middle; those on the palate form two oblong and somewhat curved patches which may be continuous. The teeth on the upper jaw are in advance of the lower jaw. The nostrils are situated wide apart; the anterior nostrils are rounded, slightly tubular and directed forwards; the posterior nostrils are considerably larger, more approximated and situated on the top of the head. There are eight barbels; one pair nasal, which extend beyond the anterior margin of the eye; one pair maxillary which are somewhat longer than the head and two pairs mandibulars which are close together at a short distance behind the tip of the lower jaw and are considerably shorter than the head. The maxillary barbels are situated in grooves which run below the eyes. The gill-openings are wide, but only the portion above the base of the pectoral fin is provided with a broad membrane and it seems probable that this portion is mostly used during respiration, as has been observed in the case of other hill-stream fishes.



Text-fig. 7.—Lateral view of type-specimen of *Clupisoma montana*, sp. nov. $\times \frac{1}{3}$.

The rayed dorsal is situated above the pectorals and is almost entirely in advance of the ventrals. Its spine and the anterior branched rays are considerably longer than the posterior ones. The dorsal spine is rather feeble, smooth anteriorly and finely serrated posteriorly. The adipose fin is small, but distinctly marked; it is situated about the beginning of the last third of the distance between the commencement of the rayed dorsal and the base of the caudal fin. The anal fin is long with about half-a-dozen anterior rays somewhat longer than the others; its base is about one-third the length without the caudal and terminates at a considerable distance from the caudal fin. The pectoral fin is long and pointed; its spine is somewhat stronger than that of the dorsal and is smooth externally and finely serrated internally; it extends beyond the commencement of the ventral. The ventrals just reach the anal opening. The caudal is deeply forked.



Text-fig. 8.—Upper dentition of two specimens of *Clupisoma montana*, sp. nov. ×4.

The depth of the body is contained from 4.5 to 4.8 times in the length without the caudal and the least height of the caudal peduncle 1.8 times in its length.

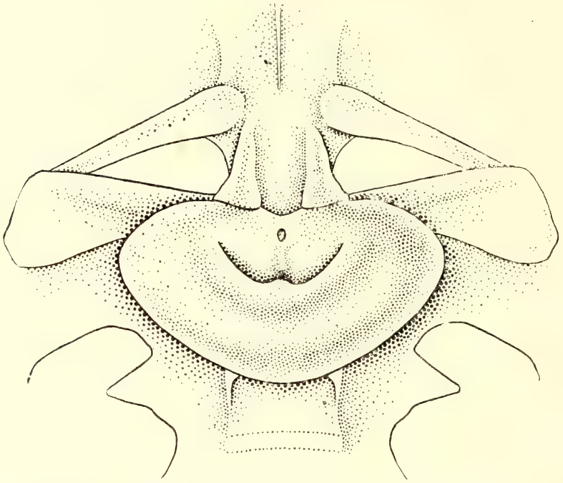
In the spirit specimens the head is dull white while the back is gray which fades on the sides. The lower portion is olivaceous. The eyes are grayish in colour.

The air-bladder is transversely ovate and greatly flattened; its anterior portion is almost solid and the posterior part is bent in the form of a semicircular canal suggesting an approach to the structure found in *Eutropiichthys* and *Ailia*. Owing to the paucity of specimens I have not been able to investigate this structure more fully.

Locality: Teesta River, below Darjeeling.

Type-specimen: F 12472/1, *Zoological Survey of India, Indian Museum, Calcutta.*

Remarks: *Clupisoma montana* can be readily distinguished from *C. garua* by the (i), relative shortness of its barbels (ii), relative weakness of its dorsal and pectoral spines (iii), presence of adipose dorsal in the adult (iv), upper dentition (v), larger number of rays in the anal fin and (vi), structure of the air-bladder.



Text-fig. 9.—Air-bladder and associated skeletal elements of *Clupisoma montana*, sp. nov. ×4.

In characters ii, v and vi the new species is more highly specialised whereas in the other three characters it is more primitive. It seems probable that the two species have evolved from a common generalised form, one taking to life in mountainous streams while other entered sluggish waters. The ecological differences in their habitats probably led to the production of two species. The generalised form is probably represented at the present day by *Clupisoma prateri*, sp. nov.

Measurements in millimetres.

Total length without caudal	237·0	241·0
Length of head	47·5	48·2
Depth of body	48·5	53·2
Width of head	30·0	30·0
Height of head at occiput	37·5	36·6
Length of snout	18·0	19·0
Diameter of eye	10·0	10·0
Interorbital width	20·0	20·0
Length of caudal peduncle	37·0	39·0
Least height of caudal peduncle	20·2	20·0
Longest ray of dorsal	39·0	45·0
Longest ray of anal	29·0	31·0
Length of pectoral	40·0	43·0
Length of ventral	26·0	25·0
Length of nasal barbel	17·0	14·0
Length of maxillary barbel	52·0	56·0
Length of outer mandibular barbel	26·0	22·0
Length of inner mandibular barbel	36·0	28·0
Length of base of anal fin	78·0	80·0

ACKNOWLEDGMENTS.

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EXPLANATION OF PLATE.

Lateral view of a specimen of *Clupisoma garua* (Ham.) from the Settling Tanks of the Calcutta Corporation Water-works at Pulta. × *ca.* ½.

The three illustrations show the changes in colouration which a specimen undergoes after its removal from water.

Top. Immediately after removal from water.

Middle. One hour after removal from water.

Bottom. Two hours after removal from water.

THE BIRDS OF BOMBAY AND SALSETTE.

BY

SĀLIM ALI and HŪMĀYŪN ABDŪLALI.

PART III.

(*With one plate*).

(*Continued from page* 530 *of this volume*).

The Great Indian Reed Warbler : *Acrocephalus stentoreus brunnescens* (Jerdon).

Field identification : A large olive-brown Warbler noticeable for its vehement call, usually found in mangrove swamps or among reeds in marshes. When calling, the orange-red inside of the mouth is distinctive.

Specimens : *B.N.H.S.* : ♂ 2-4-30 Rewās (S.A.); *St. Xavier's College* : 22 14-8-33; 236 24-4-35; Gōrēgāon.

Noted at Mahūl, Trombay, Gōrēgāon, Gōdhbunder and Powāi Lake.

This typical warbler, though surprisingly local, is not uncommon in suitable localities. It is partial to mangrove swamps and our only records away from this habitat are from the reed-beds at Powāi.

The call or song is remarkably loud for the size of the bird. At times it is ventriloquistic in character seeming to come from a different direction to whence it really does. When moving about the bushes it utters a harsh *ke ke* something like that of a Babbler.

Though long believed to be only a winter visitor to our area, there can now be little doubt that some birds at least remain to breed in the thick mangrove swamps that fringe the numerous creeks along our coast. The specimen collected at Rewās on 2-4-30 had testes measuring 6×4 mm. (see note in *J.B.N.H.S.*, xxxv, p. 450) and their presence in these parts during every month of the year may be regarded as further evidence.

That no nests have yet been actually obtained in our area is partly due to the extremely difficult country the birds inhabit. There is for instance, one two-mile patch of mangrove (*Avicennia officinalis*), *Ceriops Candolleana*, and the spiny-leaved sea-holly (*Acanthus ilicifolius*) and mud, intersected by tidal creeks, where half a dozen localised pairs may invariably to seen during July and August. Thus located it may seem an easy matter to find their nests, since the males persist in warbling vociferously from prominent positions. The mangrove and the sea-holly have, however, so far prevented our making a closer acquaintance with nesting birds.

The song is well described by Whistler as 'very loud and variable, hard and metallic for the most part, but also interspersed with pleasant bars. But the essential burden of the refrain, constantly recurring, is the loud *karra karra kareet kareet kareet* or *prit prit pritik* which suddenly bursts out of a reed-bed with astonishing vehemence'. When warbling, the throat swells out revealing a patch of dark feather-bases.

Blyth's Reed Warbler : *Acrocephalus dumetorum* Blyth.

Field identification : A smaller replica of the Great Reed Warbler found in bushes etc. both near and away from water. In the season when it is with us it is seldom heard warbling.

Specimens : *B.N.H.S.* : ♂ 22-1-11 Kheneri Island (C.A. Crump); o? 28-11-26; 17-11-27 Chembūr; 27-11-27 Tūlsi Lake (S.A.); *St. Xavier's College* : 30 o? 17-11-32 Powāi Lake (H.A.).

Blyth's Reed Warblers along with other migratory warblers are common on passage in late autumn and in spring, and many individuals also spend the winter with us. But the paucity of specimens and the difficulty of distinguishing these birds in the field do not allow many notes.

This Warbler is, however, one of the commonest and may be met with singly, hopping about in bushes, uttering an incessant *chuck - chuck*. It is less of a marsh bird than the last species. Its song—sometimes heard just before the birds leave for their breeding grounds in mid-March—is a pretty subdued chittering warble. The last date on which we have noted it, across the harbour, is 9th May which is of course exceptionally late.

The Paddy-field Warbler : *Acrocephalus agricolus* Jerdon.

Field identification : A small warbler with rufous rump found usually in tall grass, reeds or standing paddy.

Specimens : *B.N.H.S.* : o 2-12-28 Gōdhbunder (S.A.). Also noted at Kihim (Alibag District).

Winter visitor. The Paddyfield Warbler is not common in Salsette, but one or two may sometimes be put up from in amongst the patches of tall grass in semi-marshy ground bordering the Gōdhbunder creek. This, in fact, is the only locality in our area where we have come across it. It has the habit, when flushed, of skimming over the tops of the grass in a jerky flight and spreading its tail as it dives into the stems every few yards. The rufous tinge on the rump is then conspicuous.

The Tailor-Bird ; *Orthotomus sutorius guzerata* (Latham).

Local name : *Dirzee, Phitki*.

Field identification : A tiny bird about ⅔ the size of a Sparrow. Olive green above with a rusty crown and elongated middle feathers in the tail. Frequents gardens and shrubberies in town and suburbs.

Specimens : *B.N.H.S.* : Several from Vihār, Pāli Hill and elsewhere in the suburbs. *St. Xavier's College* : 49 ♂ 18-8-33 Bandra (H.A.).

Noted : *Bombay City and suburbs* : Khētwādi, Girgaum, Bhūleshwar, Chowpāti, Fort, Government House Grounds, Wālkeshwar, Warden Road, Malabār Hill, etc., Pāli Hill, Andhēri, Khār, Chembūr, Borivli and elsewhere.

Mainland : Common everywhere in suitable localities.

Resident. A familiar little bird usually seen in pairs, frequenting gardens and shrubbery everywhere in the city as well as suburbs. They frequently enter verandahs and show little fear of man. Usually hopping about amongst potted plants and small bushes uttering a loud, cheerful *to - wit, to - wit, to - wit, to - whee, to - whee*, etc. While this is being uttered the head is raised and a black crescent-shaped mark is visible on either side of the swelled-out throat. They are partial to *Bombax* and *Erythrina* flowers, and in season may be seen regularly feeding on the nectar.

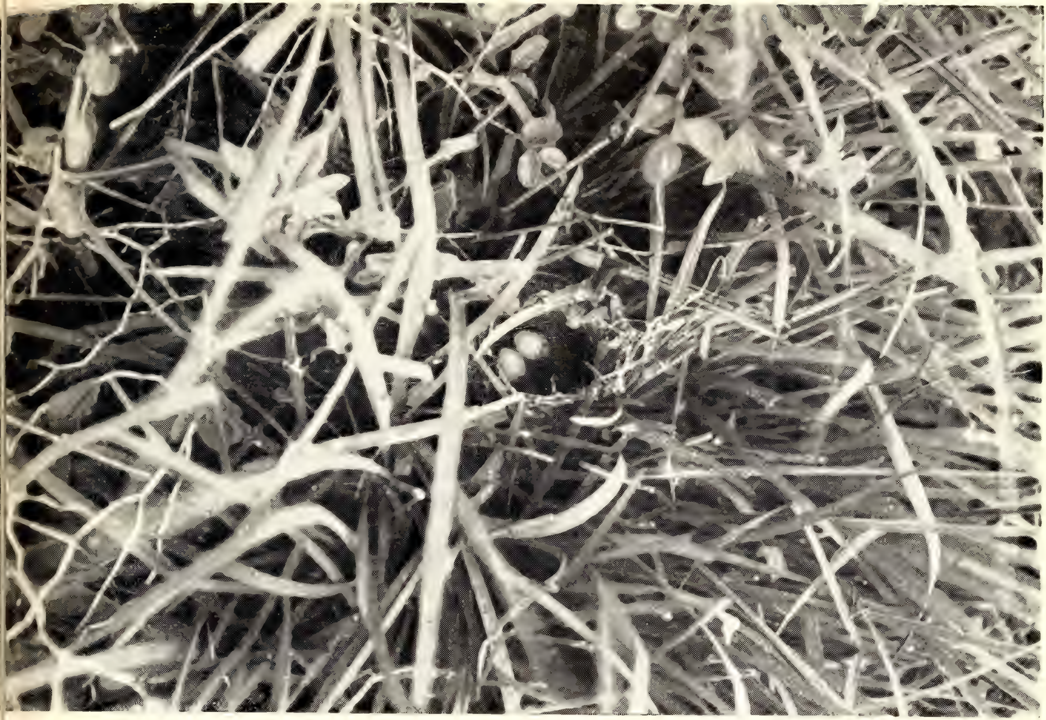
Breeding : The nesting season begins in May and lasts till October. During the monsoon not only is insect life plentiful for rearing the young, but a great many large-leaved plants spring up, such as various species of *Leea*, affording the requisite nesting sites to this and allied warblers.

The nest is placed in a funnel formed by folding over and stitching a broad leaf along its edges. Sometimes 2 or more leaves are sewn together. The stitching material is usually cotton or vegetable down which is cleverly knotted at the ends to prevent the sewing getting undone. It is said that the hen alone does the sewing, but this we have not ascertained. Within the funnel the usual type of cup-shaped nest is fitted, composed of soft fibres and cotton wool or vegetable down. It is usually within 2 or 3 feet of the ground. The lowest nest we have seen was in the leaf of a teak seedling, partly trailing - the ground ; the highest about 8 feet up in a *Terminalia catappa* or 'country almond' tree. Croton, fig and other plants growing in pots in a garden, porch or verandah are much favoured.

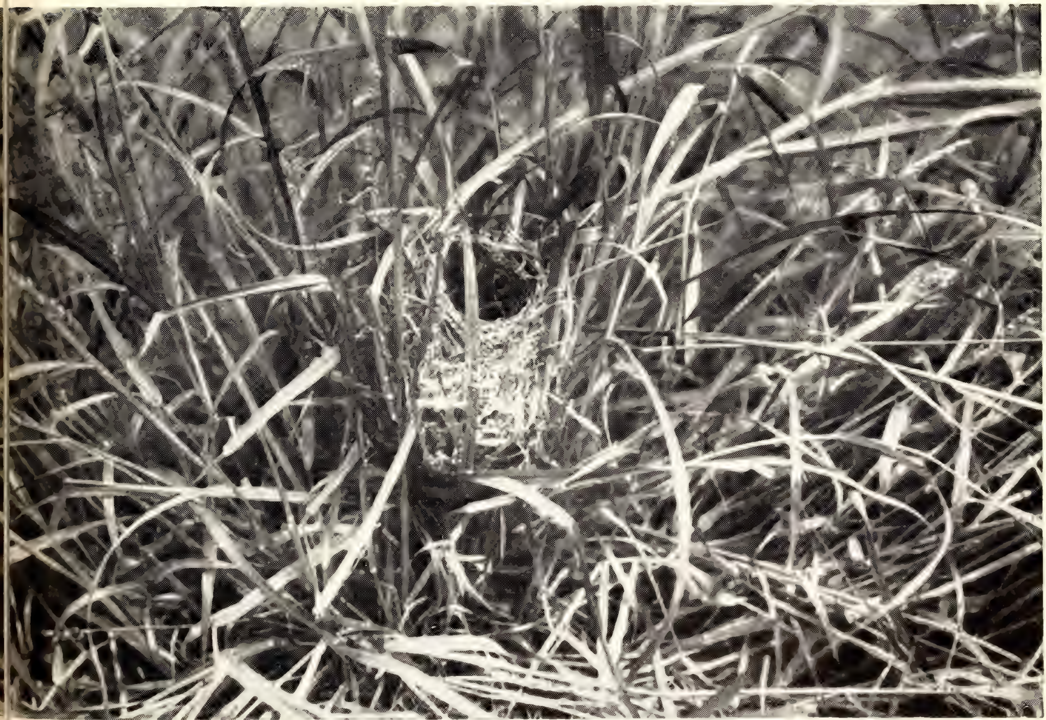
In our area a clutch of 3 eggs, or occasionally 4, seems to be the normal. We have taken both the unmarked pale blue and the red-spotted eggs here.

The Streaked Fantail Warbler : *Cisticola juncidis cursitans* (Franklin).

Field identification : Size about the same as the last. A small fulvous brown bird with black centres to the feathers of the back giving it a streaked appearance ; under parts whitish ; the rufous rump and white eyebrow are rather conspicuous. The white-tipped tail and the wandering, mounting flight accompanied by *chip, chip, chip*, as of garden shears is diagnostic. Usually frequents areas covered with tall grass and weeds,



Nest and Eggs of the Streaked Fantail Warbler (*C. j. cursitans*) at Church Gate Reclamation.



Nest of *Cisticola j. cursitans* at Church Gate Reclamation.

otos by : *Br. Novarro, S. J.*

Specimens : *St. Xavier's College* 4-7-35 Churchgate, Bombay (Back Bay Reclamation).

Noted : Gōdhbunder, Villé Pārlé, Andhēri, Bhāndūp, Kūrla, Rewās, Bassein. Resident, but shifting locally with the availability of suitable habitats. The Streaked Fantail Warbler is a recent colonist on the unappropriated reclamation area, between Churchgate and Colaba. It is quite common in the grass and rank vegetation that springs up here during the monsoon. Single birds may usually be seen up in the air, indulging in their undulating wandering flights, uttering *chip, chip, chip*. This is the first indication of the presence of the species in any locality.

Breeding : On 30 June Brother Navarro S. J. took a nest on the Churchgate Reclamation containing a clutch of 4 eggs. On 4 July 5 nests were discovered in the same area, 4 in the course of construction and 1 containing 1 fresh egg. These nests were all destroyed by grass-cutters soon after. On 30 September 2 more nests with c/5 each were located, and a third nearing completion. All the nests were built into the upright stalks of the green smooth grass (species?) which grows in tussocks on this area. They were all witihn 6 inches of the ground and practically invisible at a few feet distance.

The large number of Calotes lizards and rats inhabiting this area must cause much destruction of eggs and young.

Franklin's Wren-Warbler: *Franklinia gracilis gracilis* (Franklin).

Field identification : A tiny warbler with longish, seemingly loosely attached tail. Dusky greyish-brown above, light coloured underneath with a broad pale ashy band across the breast. Usually seen in small flocks of 3 to 5 in scrub jungle with tall grass, or in mango groves and deciduous forest with rank undergrowth.

Specimens : *St. Xavier's College* : 59 ♂ 19-8-33 Gōrēgāon 247 o? 10-12-35. Andhēri (H.A.).

Except for one record on 22-4-34 we have only come across this bird in Salsette during the monsoon from July to about December. In the breeding season males make themselves conspicuous by warbling from exposed situations such as the top of a bush or tree. The song consists of a musical or tinkling *chiwee - chiwee - chiwee, chip - chip - chip - chip* commencing low and feebly, the *chips* rising in scale and ending abruptly. Its status in our area is uncertain. It may prove to be a local migrant, but on the other hand it may conceivably have escaped notice in the non-breeding plumage which is a sober brown above and rather similar to that of the Indian Wren Warbler. The breast band is almost absent.

Breeding : This warbler breeds in Salsette and on the adjacent mainland during thte monsoon. We have the following records of nests :—

6 September (1934) Tānsa Lake with c/4 fresh.
17 September (1933) Sāki village (near Andhēri) with c/4 fresh.
10 October (1933) under construction.

The nest is similar to that of the Tailor-bird but usually somewhat more globular in shape. It is built in the broad leaves of some monsoon plant like *Leea*. The eggs in the above nests were white in one case, light blue in the other, both unspotted. Frequently they are spotted and blotched with reddish-brown.

The Rufous-fronted Warbler : *Franklinia buchanani* (Blyth).

Field identification : Size same as last. In appearance very similar to *gracilis* in the brown winter plumage, but with a rusty crown as in the Tailor-bird and a distinctive white tip to the tail. No breast band.

No specimens.

This is apparently a rare straggler into our area. S.A. has only come across it on a single occasion at Chembūr (7-6-32). Its usual habitat is drier country than that frequented by *gracilis*.

The Booted Tree-Warbler : *Hippolais rama scita* (Eversmann).

Field identification : Smaller and lither than Sparrow. Fulvous brown above, sandy-buff underneath. In general appearance very similar to Blyth's Reed Warbler, but lacking the olive tinge in the upper plumage. Frequents bushes and shrubbery.

Specimens: *St. Xavier's College*: 156 o Jūhū 31-10-33; 190 o, 191 4-4-34 Jūhū (H.A.) *B.N.H.S.* Coll.: 10-2-13 Santa Cruz (N. B. Kinnear), 3-3-29 Tūlsi Lake (*rama* or *scita?*) (S.A.).

Noted: Pāli Hill, Chembūr and throughout Salsette and commonly on the mainland.

This tree-warbler is a very common winter visitor to our area. Our earliest record is on 16 October; latest 4 April. In habits and appearance it is so similar to Blyth's Reed Warbler that the two are not infrequently confused in the field. It is very probable, moreover, that the typical race of this bird, *H. r. rama*—Sykes' Tree Warbler—also occurs within our area in winter. In the field these two races are almost impossible to tell one from the other which confounds the confusion further!

It goes about the bushes singly, searching systematically for insects and uttering *chuck, chuck* incessantly at intervals of a second or two.

The Eastern Orphean Warbler: *Sylvia hortensis jerdoni* (Blyth).

Field identification: Size slightly larger than Sparrow. Brownish slaty-grey above, whitish below with a conspicuous black cap. Tail black with some white in it. Frequents Babul and open scrub country.

Specimen: *St. Xavier's College*: 183 Jūhū 13-3-34 (H.A.).

Apparently only a rare and irregular passage migrant in spring. The stomach of our specimen contained 1 small snail, 4 seeds (sp ?) and some insect remains.

The Indian Lesser Whitethroat: *Sylvia curruca affinis* (Blyth).

Field identification: Size smaller than Sparrow—about the same as Blyth's Reed Warbler. Upper plumage earthy brown with the forehead and crown grey. Tail brown and white, chin and throat pure white, rest of underparts buffy or pale greyish white. Singly in scrub and thickets.

Specimens: *St. Xavier's College*: 162 2-11-33, 212 5-12-34 Andhēri (H.A.).

Noted: *Mainland*, Kihim; Bassein.

A passage migrant and winter visitor. Probably commoner than it appears to be but overlooked or confused with the numerous other warblers of the same size, appearance and habits that visit us at this season. The earliest date we have recorded is 7 October.

It frequents scrub-and-bush country and hunts for insects in the same way as the Booted Tree-Warbler uttering the same sort of *chuck, chuck* at intervals.

The Willow-Warblers are all tiny birds, mostly much smaller than the Sparrow, olive green or olive brown above, and varying shades of yellow underneath. They are some of our most numerous winter visitors. They flit about restlessly among the foliage of trees hunting tiny insects from the sprigs and flowers. They may often be seen clinging upside down on the sprigs or launching graceful little sallies after winged insects. While with us—in their winter quarters—they are seldom in song, but the call notes of the different species are as a rule sufficiently distinctive to furnish a clue to their identification in the field. Indeed when once authenticated, we have found the call notes to be in many cases the only means of identifying the different species more or less reliably. Wherever there are trees, these little birds will be found. We have found the following species in Bombay and Salsette, though probably several others occur besides:

Tickell's Willow-Warbler: *Phylloscopus affinis* (Tickell).

Specimen: *B.N.H.S.*: 7-3-26 Trombay Hill, Chembūr (S.A.).

Olivaceous Willow-Warbler: *Phylloscopus griseolus* Blyth.

Field identification: Easier than most members of this group that visit us. Earthy brown or greyish-brown above, yellow or buffy-yellow below with a distinctive yellow eyebrow. A brown streak through the eye. Very partial to rock-scarps, fort ruins, etc., which it clambers about, constantly flicking its wings and uttering a monosyllabic *pink*.

Specimen: *St. Xavier's College*: 185 ♂ Gōrēgāon 19-3-34 (H.A.).

This species seems to be uncommon in our area, the specimen being our only record for Salsette,

The Green Willow-Warbler : *Phylloscopus nitidus nitidus* Blyth.

Specimens : *B.N.H.S.* : 16-10-26 Kihim (S.A.) ; *St. Xavier's College* : 138 ♂ Kihim 20-10-33 (H.A.).

Tha Greenish Willow-Warbler : *Phylloscopus nitidus ciridanus* Blyth.

Specimens : *B.N.H.S.* : ♀ 19-12-08 Santa Cruz, ♀ 4-12-09 Andhēri (N.B.K.) ; *St. Xavier's College* : 130 ♂ Kihim 18-10-33 (H.A.).

These two races, which are quite impossible to tell with certainty in the field, are our commonest willow-warblers in winter. We are unable to distinguish between their call notes which are a sharp perky *chi-wee* repeated at intervals of a few seconds as the birds hop about the foliage of trees in quest of insects.

The Ashy Wren-Warbler : *Prinia socialis socialis* Sykes.

Field identification : Smaller than Sparrow. Ashy grey above, fulvous white below with a loose longish graduated tail of rufous colour tipped whitish and with a dark subterminal band. The tail is usually held partly erect and shaken up and down. Frequents gardens and shrubbery—also scrub country.

Specimens : *B.N.H.S.* : 22-3-24 Gōdhbunder, 14-6-25 Trombay Hills, (S.A.), ♀ 7-3-10 Gōrēgāon (N.B.K.), *St. Xavier's College* : 171 ♀ Borivli 19-11-33, 24 ♂ Powāi Lake 16-7-33 (H.A.).

Noted : *City* : Malabār Hill, near Chowpāti Band Stand, Government House grounds—Wālkeshwar, Pherozeshah Mehta Gardens, Victoria Gardens, Warden and Pedder Roads, etc. ; *Salsette* : Khār, Bandra, Trombay Hills, Kandivlee and elsewhere.

Resident. The Ashy Wren-Warbler is a common and familiar bird in Bombay and Salsette. Like the Tailor-bird—but perhaps somewhat less urbanly—a pair or so is found in most gardens of any size where shrubs or bushy borders occur. We have occasionally also observed it amongst mangroves.

During the monsoon months, when the birds are breeding, the males thrust themselves into prominence. They constantly climb up to some exposed situation as the top of a bush whence they pour forth their warbling feverishly. The bird flits about, jerks its tail up and down and often flutters its wings. Its laboured and undulating flight conveys the impression that the tail is much too heavy for the owner to carry.

While it feeds in the main on insects and caterpillars it is also very partial to the nectar of Tree Cotton and Coral flowers, upon which it may usually be seen.

We have repeatedly marked this bird producing the crackling noise of an electric spark described for *P. inornata* by Whistler and for *P. flaviventris* in the *Fauna*. We are doubtful as to the origin of this, but H.A. thinks that it is not vocal (see Ticehurst and Stanford *J.B.N.H.S.*, xxxiv, p. 909).

Breeding : The breeding season is in the monsoon when weeds and rank vegetation spring up affording suitable nest sites. The principal months are July, August and September. We have records of many nests in Salsette during this period. Two types of nests are found (1) of the Tailor-bird type in sewn-up leaves (2) an oblong purse of woven fibres with supporting leaves or grass stems partially incorporated into the structure. In our area the former is by far the commoner. It is usually situated less than 2 feet from the ground. The eggs, usually 3 in number, are a more or less uniform light Indian red in colour with often a darker ring round the broad end. The texture is beautifully glazed.

The Indian Wren-Warbler : *Prinia inornata inornata* Sykes.

Field identification : Similar in size and habits to the Ashy Wren-Warbler but differing from it in being a dull earthy brown with a tinge of rufous especially pronounced on the rump. The principal difference lies however in the habitats of the two species. The present is more addicted to the neighbourhood of paddy fields and to rank grass land.

Specimens : *B.N.H.S.* : 21-3-24 Chembūr, 22-3-24, 21-12-28 Gōdhbunder (S.A.) *St. Xavier's College* : 54 ♀ 20-8-33 Sāki Village ; 144 ♂ 23-10-33 Kihim, 180 ♂ juv. 25-2-34 Panvēl (H.A.).

Resident. Common. The difference in the facies mainly occupied by this and the foregoing species has been indicated above, but sometimes the two are found in the same locality. We have never observed this Wren-Warbler within city limits proper.

Its call notes and warbling are markedly different and distinctive from those of the Ashy Wren-Warbler, but it is impossible to convey an adequate rendering on paper.

Breeding: The breeding season perhaps commences slightly later than in the foregoing—in August—and we have found eggs upto the end of October.

The nest is usually a woven oblong or pear-shaped purse of fibres with the entrance on one side near the top. It is slung hammockwise between upright grass stems and some of the adjacent blades are often cleverly bent and incorporated into the structure. It is seldom more than 18 in. or 2 ft. from the ground. A favourite site is the grass and weeds growing on bunds separating paddy fields. The eggs, usually 4 sometimes 5, are a pale blue in ground colour with reddish blotches forming a ring round the broad end and interconnected by fine pencillings of the same colour. The texture is smooth and glossy.

EHA in *N. & E.* (i, 303) records eggs on 22 and 28 August.

The Indian Oriole; *Oriolus oriolus kundoo* Sykes.

Field identification: Size about that of a Myna. A bright yellow bird with black in the wings and tail and a conspicuous black streak through the eye. The female is usually duller and greener. Inhabits groves of trees and wooded country, singly or in pairs.

Specimens: *St. Xavier's College*: 70 ♂ 18-9-33 Gōrēgāon (H.A.).

Noted: *City*: Khētwādi, Grant Road, Chowpāti, Byculla, Warden Road; *Salsette*: Pāli Hill, Chembūr, Vihār, Powāi and Tūlsi Lake environs, Borivli, Gōdhbunder and elsewhere; Elephanta Island. General on mainland.

The Indian Oriole is a common winter visitor to our area from about September to April. We have seen an isolated example each as late as 9 May and 7 June.

EHA (*B. of B.*, p. 95) says these birds leave us about the beginning of the hot season and go to drier climes inland to bring up their young, returning in September. This no doubt is correct.

Single birds or pairs may commonly be seen in gardens in the city as well as in the suburbs. It frequents well-wooded country, and large shady trees such as Banyan, Peepal, Mango and Tamarind are much patronised.

Their usual call notes are a harsh *cheeah* and a rich mellow whistle something like *Pe-lo-lo*. The food consists of Ficus figs, and berries of various kinds to which are added on occasion insects and the nectar of flowers such as *Bombax* and *Erythrina*.

Breeding: We cannot trace any record of its breeding on the mainland in our neighbourhood or in the Ghats.

The Black-headed Oriole: *Oriolus xanthornus maderaspatanus* Franklin.

Field identification: Size same as last. A brilliant golden yellow bird with jet black head, throat and upper breast. Black in wings and tail. Frequents groves and well-wooded country singly or in pairs.

Specimens: *St. Xavier's College*: o 23-7-33 Borivli, Salsette (H.A.).

Noted: *City*: Only Malabār Hill, Cumballa Hill, and Wālkeshwar. Common generally in the suburbs and Salsette.

Resident, but partly also local migrant. There is a marked increase and decrease in its numbers at the commencement and end of the cold weather.

In habits it does not differ appreciably from the Indian Oriole, though it seldom ventures into the low country. The harsh monosyllabic note commonly uttered is very like the first note of the Tree-Pie and may frequently be mistaken for it.

The adult male and female are alike in appearance and what is described as the female plumage in the *Fauna* (iii, 12) is merely that of the immature bird.

Breeding: We have found nests in Salsette, on Mount Poinsur and in the Tūlsi Lake environs, on 11 and 14 July. The latter contained 1 newly hatched young. The nest is a neat cradle of fibres, slung hammockwise in the horizontal fork of twigs near the extremity of an outhanging branch of Mango, *Bassia* or some other large tree. It is usually placed at a height of 20-30 feet from the ground. On 2 July (1933) an adult was observed chasing off a crow from the vicinity of a young bird lately out of nest, with unsteady flight and a stub tail. The normal clutch consists of 3 eggs.

It has been repeatedly observed that Orioles, along with such other mild mannered birds as doves and babblers build in the same tree as holds a drongo's nest. Whether this be by accident or design, there is no dobut that the birds thereby enjoy a certain amount of protection against marauders like crows. The king-crow will placidly tolerate their neighbourhood but a crow has only to show himself near the nest tree to be set upon and beaten off by the valiant owners!

The Southern Grackle : *Gracula religiosa indica* (Cuvier).

Talking or Hill Myna.

Field identification: A glossy jet black bird, slightly larger than Myna, with yellow bill and legs and bright orange yellow patches of naked skin and wattles on the head. A favourite cage bird. Usually seen as such in the Crawford Market and with fanciers.

Straggler? The only occasions on which we have come across this bird in our area are: (1) A solitary bird at Pāli Hill 1-4-24 and (2) A pair in a tall and leafless tree in the forest by the Tūlsi Lake on 29-3-31. The former may possibly have been an escaped cage bird.

About 1924 Mr. M. Suter of Bombay in a letter to the Society wrote: 'I have shot recently a specimen of the Southern Hill Myna (Grackle) which therefore seems to occur on Salsette Island'. Ordinarily this grackle is an inhabitant of the evergreen forest tracts of S.W. India and Ceylon.

The Rosy Pastor or **Rose-coloured Starling** : *Pastor roseus* (Linn.).

Local names: Raan Shalé (Mahratti), Hyya, Wyha, Jowari Bird.

Field identification: Size about that of Myna. Head and crest, throat and upper breast glossy metallic black. Wings and tail black. Rest a beautiful pale rose-pink. Noisy flocks seen principally on the leafless flowering Silk Cotton Tree.

Common in winter from about October to April but the arrival of the main body in our midst coincides more or less with the flowering of the Silk Cotton Tree (*Bombax malabaricum*) about mid-January, and their departure with the end of the flowering season, i.e. end of March or early April. When the *Bombax* is in flower Rosy Pastors are perhaps the most regular and numerous habitués to them and during the greater part of their sojourn here they seem to subsist almost entirely on the nectar. They are present wherever a *Bombax* tree is flowering, be it actually within town limits (such as Marine Lines, Elphinstone Circle Gardens, Cruikshank Road and elsewhere) or in the suburbs and less inhabited parts of Salsette. They seem to function as important cross-pollinating agents for this tree, collecting the pollen on their head feathers in their attempts to reach the nectar, and transferring it on to the mature stigma of the next flower. The flowers of the Coral Tree (*Erythrina indica*) are also patronised but to a lesser extent. Ficus figs and berries of various species are largely eaten. We have found *Lantana camara, Streblus asper* and *Salvadora persica* to be almost invariably present in the stomachs of birds examined in our locality.

During the time they are with us, thousands of birds collect every evening in the cocoanut palms at Jūhū to roost in company with Mynas.

The Rosy Pastor is a natural enemy of locusts and a useful check on their numbers. Its breeding grounds in Russian Turkestan coincide with those of the locusts, and it wreaks enormous destruction among the insects in every stage of their life history. In India the birds do a certain amount of damage to ripening Jowari crops, but on the other hand are a great help to the ryot during times of locust invasions when they destroy enormous numbers of locusts, many more than they actually eat.

The Grey-headed Myna : *Sturnia malabarica malabarica* (Gmelin).

Field identification: A small trim Myna. Common. Grey above with blackish wings. Throat and breast pale lilac-grey, rest of underparts rusty brown, darkest under tail. Small flocks in open secondary jungle and thinly wooded country.

Specimens: *B.N.H.S.*: ♂ ♀ 5-2-24 Pāli Hill; 19-9-26 Kandivlee (S.A.); ♂ ♀ 5-12-28 Bandra (E. Henricks); *St. Xavier's College*: 4 ♂ 9-2-33 Kihim (H.A.).

Noted: *City*: Warden Road, Nepean Sea Road, *Salsette*: Chembūr, Trombay Hills, Borivli, and elsewhere.

The Grey-headed Myna is a resident in small numbers in Salsette but it is largely a local migrant. There is a marked influx in its numbers in about September which lasts till the beginning of the hot weather.

The birds are usually met with in pairs or small flocks of 6-8, often in association with Common and Brahminy Mynas and Rosy Pastors. They are regular attendants on Silk Cotton and Coral flowers for the nectar. There is a great deal of squabbling and chasing about from branch to branch and from one flower cluster to another when a flock is on the scene. Lantana berries and figs of the Banyan and Peepal are also largely eaten.

Breeding: We have no record of its breeding in our area.

Blyth's Myna; *Sturnia malabarica blythii* (Jerdon).

Field identification: Differs from the last chiefly in having the whole head, neck and breast white instead of silvery grey.

Specimens: *St. Xavier's College*: 5 ♂ 23-7-33 Tūlsi Lake environs.

The discovery in our area of this race of the Grey-headed Myna is of great interest. It is the South Indian form of the bird and not recorded previously north of South Konkan. The specimen was solitary and apparently a straggler.

We have, however, from time to time observed individuals amongst flocks of Grey-headed Mynas which have looked suspiciously like this bird. It is possible that on further investigation it may prove to wander into our area less rarely than has been supposed.

The Black-headed or **Brahminy Myna**: *Temenuchus pagodarum* (Gmelin).

Field identification: Somewhat smaller than the Common Myna. Grey above, rich buff or reddish-fawn below, with black wings and blackish tail. Head and a long crest glossy black. The broad grey edging of the somewhat wedge-shaped tail is conspicuous when it is spread before the bird alights. Small flocks in secondary jungle and fairly wooded country, frequently in association with Grey-headed Mynas.

Specimens: *B.N.H.S.*: ♀ imm. 9-11-12 Santa Cruz (N. B. Kinnear); *St. Xavier's College*: 149 juv. Nov. 33 Kihim (H.A.).

Noted: *City*: Warden Road, *Salsette*: Pāli Hill, Khār, Andhēri, Jūhū.

A winter visitor to our area, arriving about September/October and leaving March/April.

Flocks usually contain 6-12 birds either by themselves or in association with Common and Grey-headed Mynas. When they first arrive, the flocks are really family parties or multiples of family parties, and contain a great many young birds in juvenile plumage. Besides their typical frowsy appearance, the young differ from adults in having the crown and head chestnut instead of black, and in the absence of the crest.

The birds feed on grasshoppers and other insects, frequently striding along or hopping amongst grazing cattle. They are also very partial to Banyan and Peepal figs and Lantana berries. We have observed them eating the figs of *Ficus retusa* and berries of *Bridelia* and *Mimusops hexandra*. Along with others of their ilk they may commonly be seen on *Bombax*, *Erythrina* and *Butea frondosa* flowers, the nectar of which seems irresistible. It has quite a sweet song, heard on the approach of the breeding season, and is often kept as a cage bird.

Breeding: We have no evidence that it actually breeds within our limits. The nearest localities where we have found nests are Panchgani (4,000 ft., June/July) and Khandala (2,000 ft.) in the Western Ghats.

The Common Myna: *Acridotheres tristis tristis* Linn.

Local Name: *Shalé* or *Salonki*.

Field identification: After the crow, kite and sparrow certainly the commonest and most familiar bird not only of Bombay and Salsette but of practically the whole of India. A jaunty, perky, well-groomed dark brown bird with glossy black head and neck and bright yellow bill, legs and bare skin around the eyes. In flight a white bar is conspicuous in the open wing, and the tail is also bordered white. We cannot imagine that any local resident old or young is unfamiliar with this bird, but in any case the above clues, down and across, should leave no possible doubt in his mind. Usually seen in pairs or family parties in town in suburb and the countryside.

Specimens: *St. Xavier's College*: 32 ♂ Andhēri 28-7-33; 2230 ? Powāi Nov. 34 (H.A.).

Noted: *City*: Grant Road, Bhuleshwar, Warden Road, Esplanade and other maidans, Chowpāti, Back Bay Reclamation, Willingdon Club grounds, etc. *Suburbs and adjacent mainland*: ubiquitous.

Common. Resident. Very partial to water-logged ground where it digs up worms. An unfailing attendant on grazing cattle, prancing with a sideways gait amongst their legs, riding on or hopping about their backs and appropriating any grasshoppers and other unfortunates disturbed by the progress.

When the grass is tall it is amusing to watch the birds springing up from time to time to spy out their surroundings in the manner of a terrier.

The Common Myna is more or less omnivorous in its diet, and like the House Crow will eat anything it can come by. H. A. once saw an individual carry off a dead field-mouse. Banyan and Peepal figs, wild dates or Lantana berries are uniformly relished and the nectar of *Bombax* and *Erythrina* is regularly eaten.

When the winged termites emerge from the ground during the monsoon months, Mynas are amongst the vanguard of the avian epicures that foregather to the feast. They vie with the crows in the ungainliness of their aerial antics after the insects and often dally in the chase till well after dusk.

It has a large repertoire of call notes and being such a familiar and by no means reticent bird, one soon learns to recognise the various emotions expressed by the calls. Alarm, agitation, pleasure, soon become so eloquent that one can usually guess what is afoot long before the birds themselves are visible. The harsh swearing cry of irritation combined with fear, for instance, which is accompanied by a drooping and shivering of the closed wings when a snake is sighted is quite unmistakable. Indeed a great many different species of birds also readily recognise this signal and rally to the moral support of the resentful mynas.

At Kihim we have observed that parties of Common Mynas, often augmented by Jungle Mynas, fly out regularly to the rocks on the sea-shore exposed at low tide. We have been unable to ascertain the true purpose of these flights, but from the short time the birds remain there, we can only conjecture that they do so to drink the salt water in the same way as many mammals do.

Breeding: Nest building commences in May and most eggs may be found in June and July. By September family parties are usually out, the clamouring young being led about and tended by the parents. Two successive broods are not uncommon. The nests in Salsette are placed in holes in stems of date and palmyra palms where they are more or less inaccessible, but holes and hollows in any large tree are utilised. The nest—an untidy collection of rubbish—is frequently built under the eaves or in the ceilings of inhabited houses in the suburbs. Four or five eggs are usually laid of a pretty uniform blue colour with a slight gloss.

The Bank Myna: *Acridotheres ginginianus* (Latham).

Field identification: Like the Common Myna but somewhat smaller and with the general colour pale bluish grey.

A rare straggler (?). Apparently not heard of in our area since 1900. In that year a number of unusual birds were driven far south of their accustomed haunts in search of livelihood owing to the severe drought in Gujerat where the Bank Myna is common (*J.B.N.H.S.*, xiii, 398).

Ten years before this, in 1890, Barnes (*J.B.N.H.S.*, v, 106) wrote: 'I have seen it in the city of Bombay busily employed in excavating holes in the embankment of the Wodehouse Bridge near the Railway Station at Colaba; they did not, however, breed there as the boys persecuted them too much'.

EHA did not meet with it in Bombay (*B. of B.*, p. 127).

The Jungle Myna: *Æthiopsar fuscus mahrattensis* (Sykes).

Field identification: In general appearance not unlike the Common Myna but with a tuft of long black feathers on the forehead, at base of bill, and no bare yellow skin round the eye.

Specimens: *St. Xavier's College*: 145 ♂? 25-10-33 Kihim (H.A.).

Noted: *Salsette*: Mulund (once), Kandivlee (once); *Mainland*: common at Kihim (Alibag) and in South Konkan.

The status and local distribution of this myna in our area and the neighbouring country seems curious and inexplicable. On the adjacent mainland—at Kihim, across the harbour, and even at Parsik near Thana—both this species and the Common Myna are equally common. The habits of the two do not seem to differ appreciably except that the former is not so much of a house bird. They breed at the same season, often using the self same nest holes in alternate seasons. Yet in Salsette, except for the one record in all these years by H. A. at Mulund and for another small flock of 5 birds observed by S. A. at Kandivlee in a different year, it appears to be absent! A similar peculiarity in the local and patchy distribution of the Jungle Myna in Travancore has been pointed out by Sālim Ali (*J.B.N.H.S.*, xxxviii, 504).

East of Bombay the farthest we have come across it is 8 miles from Panvēl towards Chauk village. It is common about the Tānsa Lake.

Many years ago Davidson (*J.* v, 107) noted it as occurring in Thana and Bombay.

Breeding: We have found the Jungle Myna nesting commonly at Kihim in May. The nest is a mass of feathers and rubbish finished off with a piece of snake-slough, onion peel or tissue paper! It is placed in natural hollows principally in Casuarina, bhend (*Thespesia*) or Oondi (*Calophyllum inophyllum*) trees 10-30 ft. from the ground. Three or four eggs similar to those of the Common Mynas are laid. The incubation period is 16 days.

(*To be continued*).

FISH OF DEOLALI.

PART II.

ECOLOGICAL AND BIOLOGICAL OBSERVATIONS.

(*With one plate*).

BY

A. G. L. FRASER, I.M.D.

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PREFATORY NOTE.

The following series of notes contains ecological and biological observations made by Mr. A. G. L. Fraser on certain fishes of the Deolali area both under field and laboratory conditions. The author used vernacular names in his descriptions but I have given the corresponding scientific names of the species throughout; in places the text has been revised so as to bring it in conformity with the literature on the subject. Explanatory notes have been added wherever it was found possible to give some adequate reasons for the valuable facts observed by Mr. Fraser. Dr. Albert W. C. T. Herre happened to be in Calcutta when I was revising these notes, and I availed myself of this opportunity to have the matter looked over by him. He very kindly read the revised manuscript and was able to add a note on the surface-swimming habit of the Cyprinidae of the Far East.

The observations recorded here by Mr. A. G. L. Fraser are extremely valuable, especially as they are based on abundant material and were carried out during all the seasons of the year. Special attention may be directed to the function that has been assigned to the hypertrophied lower lip of *Rasbora labiosa* Mukerji and *Danio fraseri* Hora. From an analogy of similar structures found in certain Amphibian tadpoles, it was presumed by Mukerji and the writer that the structure was probably used for hanging from the surface film; but Mr. Fraser has conclusively shown that the enlarged lower lip is meant to seize and hold insects for which the fish jump several inches out of the water. This shows how similar structures may sometimes be used for totally different functions.

The arrangement of matter proposed in the first part had to be modified as the descriptions of new species and notes on rare forms could not be completed in time for inclusion in this part of the *Journal*. In some respects the present arrangement seems to be more suitable.—*S. L. Hora.*

1. A NOTE ON THE HIGH MORTALITY INCIDENCE OBSERVED AMONGST SURFACE AND GROUND FISHES (EXCEPTING THE OPHICEPHALIDÆ) ON THEIR TRANSFERENCE FROM THE NATURAL ENVIRONMENT TO AN AQUARIUM.

In the experiences connected with the keeping of fishes in an aquarium, the problem encountered and beset with difficulty was how best to reduce the high mortality which invariably occurs amongst any given number of fishes on their introduction into the aquarium. A rough assessment of this mortality rate shows that 30 per cent die almost at once or within a few hours of the transference. A further 30 per cent. die within 24 hours and 10 per cent. up to 48 hours. In studying these losses with a view to reduction of mortality, the various factors prevailing in the water of the aquarium i.e. (1) temperature (2) alkalinity (3) absence or presence of currents (4) mechanical aëration (6) food supply and (7) the physical character of the bed and the surroundings, were considered in turn and, despite all practical efforts to bring conditions in the aquarium to approach as near as possible those of the river or streams, the mortality figures continued fairly constant. Excluding the *Ophicephalidae,* which were tenacious of life, with a death rate of only 10 per cent., the surface fishes generally showed a higher proportion of deaths as compared with other ground species. No matter what kind of water was used, whether from the river, stream, well or tap, the relatively small percentage of species which ultimately survived were those able to live in any kind of water, provided always, that it was slightly alkaline to litmus paper. Such fishes lived for the five months of observation, even when, as was the case with one batch, the water had not been changed for eleven weeks.

Of the surface fishes, roughly 30 per cent. of the following species survived the transference and showed clear indications of a very high physical capacity for adapting themselves to the conditions in a small improvised aquarium.

(1) *Barbus ticto* (Ham.).—Bhil name :—*Tiptoo*
(2) *Rasbora labiosa* Mukerji.—Bhil name :—*Gayroonjee*
(3) *Danio fraseri* Hora.—Bhil name :—*Gayroonjee*

All these species are found in both rivers and streams in this area. Excepting the first, the two others are normally more numerous in the streams.

In the case of *Barilius bendelisis* Ham. (Bhil name :—*Jhor* or plural *Jhoria*) the mortality in the early trials was cent per cent. Later, it was ascertained that if salt was added to the water in a quantity sufficient to render it strongly alkaline to litmus paper, the death rate was reduced to 90 per cent. Any further additions of salt did not improve the situation and 10 per cent. of any given number survived and could live on if the water was brackish.

Amongst all other surface species which were recovered from the rivers there was a high degree of susceptibility—from 15 minutes to two hours at most—with a cent per cent. mortality which could not be influenced under any circumstances. This I think can be attributed to the absence of strong currents which it was impossible to reproduce in a small aquarium. In this respect the Chilwa [*Chela clupeoides* (Bloch)], Bhil name—*Phal* or plural *Phalay* and *Ambassis ranga* (Ham.) with the Bhil name of *Bing* are notable as they were found associated together in sections of the rivers where there were very strong swirling currents in evidence.

The ground species, excepting the *Ophicephalidae,* showed generally a 50 to 60 per cent. mortality and the fishes which best adapted themselves in the improvised aquarium were the following:—

(1) *Cobitidae*: There were four species, viz., *Lepidocephalichthys guntea* (Ham.), *Nemachilus botius* (Ham.), *N. denisonii* Day and *N. evezardi* Day. All of these lived well in the aquarium, but one of them, *L. guntea* (Ham.), with the Bhil name of *Mohroo chopra,* proved to be the better adapted as it lived through the six months of observations.

(2) A ground species (Bhil—*Kharandya*) [*Garra mullya* (Sykes)].

(3) A Siluroid:—Bhil name, *Khirkirya* [*Mystus cavasius* (Ham.)].

In the case of *Garra mullya* (Sykes)—Bhil name, *Mallia*—there was a fifty per cent. death rate but the surviving numbers did not live for more than 4 days in the aquarium and during this period showed much respiratory embarrassment. They periodically and frequently rose to the surface and by muscular action alone, maintained themselves perpendicularly suspended, but not by their lips, for 30 to 35 seconds. While thus engaged, they create a froth of bubbles. This species is really not a good aquarium type. Other ground species showed a cent per cent. mortality.

Most of the ground species were recovered from the rivers. The *Cobitidae* appear to be generally distributed in both the rivers and streams.

The results of the observations made it clear that in a small improvised aquarium only those species survive which are habituated to living in still water pools of rivers and streams or in pools where the currents are only of slight intensity. It would appear, therefore, that if other species are to survive in an aquarium for purposes of observation the water in it must be so arranged that strong currents[1] pass through it at all times and, while allowing of a wide surface expanse its volume and depth must be adequate. These conditions, plus a slight alkalinity and a bed of a varied nature consisting of rock, sand, silt, and under water vegetation to suit the different kinds are equally necessary. It has not been possible for me to do this.

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[1] Owing to strong currents, the water becomes well oxygenated and it is usually difficult to keep rapid-water forms in aquaria. By aërating aquarium water artificially, it is, however, possible to acclimatise a certain number of these fishes to aquarium conditions.—*S. L. Hora.*

The question as to why there should be a high mortality rate amongst the species, of which a small percentage were able to survive the ill-adjusted conditions in a small improvised aquarium, is of interest. Theoretically, if conditions were so adverse as to kill the majority none should have survived. Whether death of the majority was due to shock as the result of a highly nervous complex reacting badly to the new environment is a possible causative factor but not easily ascertainable; but there is no doubt that the few surviving individuals showed a capacity and resistance of a high and peculiar quality, apparently inherent in themselves, for, though placed in an ill-suited environment, they were quite at home in it. Were it not due to this high adaptive power of the few it would not have been possible to carry out the experiments and observations of which the records are appended.

It is possible also that the range of variability is much less among the survivors than in those eliminated. This was found to be the case by the American zoologist, Bumpas who measured 136 injured specimens of the common sparrow collected after a severe storm. Out of this number 72 revived while 64 died. On measuring the dead birds and comparing them with the survivors he ascertained that the former on the average were longer and heavier than the latter and significantly also showed that the range of variability was distinctly smaller among the living birds. In this respect the transference of fishes from their natural environment to the aquarium can be likened to a storm. Unfortunately I am not competent to undertake these measurements of the fishes involved. Such measurements if they are to be reliable must be undertaken on freshly dead specimens as preserved fishes are unsuitable for obvious reasons of shrinkage. I have, however, put up separately in two lots such batches as were observed.—(1) Those that died almost at once or within 48 hours and (2) the numbers which ultimately survived and would have continued to live indefinitely had not the observations terminated for lack of facilities. Should these fishes be measured and the comparative study reveal physical differences it should furnish valuable evidence that those individuals which depart least from the 'ideal type' have on the whole the best chance of surviving.[1]

2. NOTES ON DISTRIBUTION AND HABITS OF CERTAIN FISHES.

In the course of making the collection and from the experiences and impressions gathered after eleven months exploration of the tributary streams and rivers in the Deolali area the following features were noted as regards the distribution and some of the habits which have been observed.

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[1] Dr. S. L. Hora of the Zoological Survey of India, who, in collaboration with Mr. K. S. Misra, has investigated the fish fauna of Deolali informs me that the specimens kept in the aquarium for a long time are very lean and attenuated. In fact he found them so different from the normal individual that in the preliminary sorting he regarded them as belonging to different species. This was particularly so in the case of *Lepidocephalichthys guntea* (Ham.) and *Danio fraseri* Hora. Such a condition was probably due to insufficient nourishment under aquarium conditions.

Serial number and number in order of dominance	Scientific Name	Bhil Name	Present in rivers	Present in streams
1. (29)	*Notopterus notopterus* (Pallas.).	Chambree	X	...
2. (33)	*Anguilla anguilla* (Ham.)	Ahhir	X	...
3. (7)	*Chela clupeoides* (Bloch)	Phathree, Phal	X	...
4. (2)	*Barilius bendelisis* (Ham.)	Jhor	X	X
5. (11)	*Danio fraseri* Hora	Gayroonjee.	X	X
6. (32)	*Rasbora daniconius* (Ham.)	Gayroonjee.	X	...
7. (3)	*Rasbora labiosa* Mukerji	Gayroonjee.	X	X
8. (30)	*Aspidoparia morar* (Ham.)	Ambli	X	...
9. (17)	*Barbus chola* (Ham.)	Bhokria	X	...
10. (5)	*Barbus khudree* (Sykes)	Waris	X	...
11. (6)	*Barbus kolus* (Sykes.)	Kholis	X	...
12. (15)	*Barbus sarana* (Ham.)	Bhodeer	X	...
13. (1)	*Barbus ticto* (Ham.)	Tiptoo, Tiplee	X	X
14. (16)	*Cirrhina reba* (Ham.)	Arrol	X	...
15. (24)	*Crossichilus latius* (Ham.)	Warootee	X	...
16. (4)	*Garra mullya* (Sykes)	Mallia, Kharandya	X	X
17. (10)	*Labeo boggut* (Sykes)	Sandekol	X	...
18. (23)	*Labeo porcellus* (Hackel)	Khanoos, Ghoghir	X	...
19. (27)	*Rohtee cotio* (Ham.)	Goorda	X	...
20. (28)	*Rohtee vigorsii* (Sykes)	Kuplee	X	...
21 (12)	*Lepidocephalichthys guntea* (Ham.)	Mhorroo, Mohroo thail, Mohroo chopra	X	X
22. (13)	*Nemachilus botius* (Ham.)	Mhorroo, Mohroo chickna.	X	X
23. (14)	*Nemachilus denisonii* (Day.)	Mhorroo, Mohroo yaree	X	X
24. (18)	*Callichrous bimaculatus* (Bloch)	Monee	X	...
25. (22)	*Wallago attu* (Bloch and Schn.)	Baloo	X	...
26. (9)	*Mystus cavasius* (Ham.)	Khirkirya	X	...
27. (31)	*Glytothorax lonah* (Sykes)	Khordoo	X	...
28. (21)	*Nangra viridescens* (Ham.)	Bibua	X	...
29. (25)	*Proeutropiichthys taakree* (Sykes)	Sonar	X	...
30. (20)	*Ophicephalus gachua* (Ham.)	Dhakay, Dakhia	X	X
31. (26)	*Ophicephalus marulius* (Ham.)	Murral	X	...
32. (8)	*Ambassis ranga* (Ham.)	Bing	X	...
33. (19)	*Glossogobius giuris* (Ham.)	Kharbya	X	...

In the above Table the species are shown as found (*a*) in the rivers and (*b*) in the tributary streams; their order of dominance is also noted. The order of the dominance shown is judged by the numbers taken of each species[1] and is possibly not quite a true index, but it is near enough for all practical purposes. It will be observed from the Table that, of the total of 33 species tabulated, quite a large number found in the rivers, were not found in the streams. Nine species only of the total were found in both the rivers and streams. Of this number only three can be said to be truly stream species. These are *Rasbora labiosa* Mukerji, *Danio* (*Danio*) *fraseri* Hora and a ground species with the Bhil name of *Kharandya* [*Garra mullya* (Sykes)]. Their presence in the rivers can be accounted for by the fact that the monsoon storm waters force them in. During the dry seasons of the year their numbers in the rivers are comparatively scanty, while in the streams they are very numerous. The remaining six species appear to be equally distributed in both the rivers and streams.

Chela clupeoides (Bloch).—Bhil name, *Phal* or *Phalay*.

A long, laterally compressed, silvery white fish, stained greenish yellow dorsally. The ventral surface is arched in the long axis; dorsally it is concave, with a sharply upturned mouth. They are recoverable only from the rivers, most often in midstream where the currents are swirling and strongest and in sections where the bed is rocky and sanded or part silted. They move about in shoals and prefer stretches of the river which have a wide expanse, and are absent from sections where there are villages upon the banks. They have been found associated with what appear to me to be *Ambassis ranga* (Ham.), (Bhil name, *Bing*)—a fish so pale and transparent that when alive, the vertebral column, and anteriorly below it and wedged above the stomach, the swim bladder and the bones in its body are clearly defined. After death it becomes opaquely white. With the *Chilwa*, it shares a preference for localities where there are strong currents. *Chilwa* are particularly susceptible and do not live for more than a few minutes in the aquarium. Ten per cent of the *Bing* are capable of living in the aquarium. They never rise to the surface at any time and do not behave as other surface species do. They remain stationary the whole time and rarely if ever move about keeping a position about 2 inches from the floor. They readily devour larvae and also green algae. The mouth is always kept open and only the lower lip is slightly raised in the act of breathing. The *Chilwa* is insectivorous. I have seen them rise to take small blue dragon flies.

Barilius bendelisis (Ham.).—Bhil name, *Jhor* or *Jhoria*.

Hora and Mukerji in the *Records of the Indian Museum*, vol. xxxvii, part iii, have mentioned two species of Barils in their report on the small collection which was first sent from Deolali. The name *Jhor* is used by Bhils for both species. *B. bendelisis* is dark-coloured dorsally with yellowish fins and a series of transverse jet black or purplish black streaks running from a dorsal ridge to the mid-body near the lateral line. In spirits, the dark dorsal colouration

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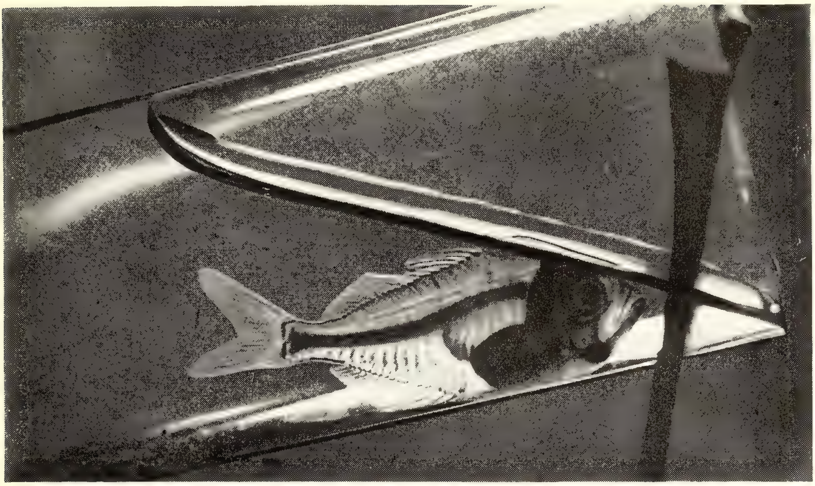
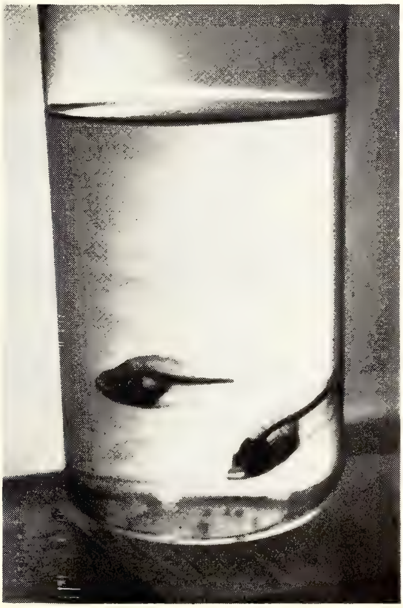
[1] The material sent to us for examination does not bear out, in a few cases, the order of dominance of the species as noted by Dr. Fraser. It is quite possible, however, that we did not have the whole material for examination.—*S. L. Hora.*





Photos showing the transparency of the fish *Ambassis ranga* (Ham.) known to Bhil fishermen by the name of *Bing*. The swim bladder and vertebral column are clearly defined.

of large specimens fades to yellow. The young show lighter colour tones and the transverse streaks are much more pronounced. This fish is found both in streams and rivers and favours parts which are silted up and where there is only a mild surface current. During dry periods of the year they are more numerous in the streams, especially in the sections of the 'North Nallah' which run by the Deolali Cantonment Bazaar. Here there is much washing of clothes done and the water is soapy and foul-smelling. Batch No. 32[1] in the present series is a good example of a catch of this species only, containing both large and small specimens taken from the locality mentioned. The water here is always strongly alkaline to litmus paper. This is an important point as this species is a bad aquarium type and I have mentioned previously that a cent per cent. mortality was reduced to 90 per cent. simply by adding salt in sufficient quantity to make the water in the aquarium strongly alkaline. Curiously enough, Batch No. 37 taken on 30th January 1936 from the Darna river were all very young specimens which were caught at the sides of the river in a portion which was but a few inches deep and where there was no current. The bed was a silt-covered sanded section, and here also the water was strongly alkaline, while the temperature at 3 p.m. was 86°F. In contrast with this, the water at a 2 ft. depth in the current of the river was slightly alkaline and the temperature 76°F. No big specimens of this species were caught in this locality on that day. Confirmatory proof of the fact that only this species is recoverable in the section of the 'North Nallah', referred to above in connection with Batch No. 32, is again furnished by the catch obtained on 10th February 1936. Batch No. 39 (see also Batch No. 50 of this series) contains this species. On this day the temperature at 4 p.m. was 86°F. and the water was strongly alkaline. These fish feed well on mosquito larvae and leap for midges when they fly above the surface level. Batch No. 11 containing three specimens were taken on rod and line with a worm bait on 29th August 1935. I have since ascertained that they swallow worms readily. Worms can be got at any time of the year from the section of the North Nallah where this fish is found. The bed is silted over a rocky base and the worms are to be had in the silt and from the edges of the stream. The fish have been observed to partly bury themselves head up in the silt and some have been caught in this way by simply removing the silt and picking them out from it. I have tried silt in the aquarium but this does not help to reduce the mortality. Egg-bearing females were found in March.

Danio (Danio fraseri) Hora.—Bhil name, *Gayroonjee.*

Much of what is given below as regards the habitats of *Rasbora labiosa* Mukerji equally applies to this species which is insectivorous probably throughout its life. The colour in the living state is silvery with a pinkish blush which is also in evidence on the fins. The lateral striations on the long axis of the body are of a blue colour which fades to just perceptible lines when the fish are kept in the aquarium for any length of time, when they also lose the pink blush, becoming silvery white. In spirits, the striations become quite dark and much of their original freshness is lost.

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[1] These numbers correspond with the locality numbers as given in Part I of the present series.

Rasbora labiosa Mukerji.—Bhil name *Gayroonjee.*

This fish is easily the dominant type in the streams, where they are very numerous. At the origin of the 'Narsullah Wadi' (see bach No. 14—12th September 1935) they were found associated with *Nemachilus denisonii* Day (Bhil name, *Mohroo yaree,* a banded fish). During the dry months of the year comparatively few are recoverable from the rivers, where only adult specimens measuring from 4 to 6 inches in length are usually present. In the streams they have been observed moving about in small shoals—of about 40 or more, consisting chiefly of the smaller fry. They are nearly all of uniform size and appear to have been hatched out at the same time. Very young ones 1.0 cm. in length have been found in the shallows of sanded beds at the edges of the streams where they can be caught by cupping one's hand into a hollow. This is a hardy fish and makes a good aquarium type. They are capable of living in very foul water and were recovered from stagnant pools and the marshy pockets of the streams which become clogged with algae and show a heavy surface scum. Significantly enough 80 to 90 per cent., taken from the stagnant sections survived in the aquarium, provided they were kept under identical conditions in the same kind of foul water with algae in it. A batch was kept for eleven weeks continuously without the water being changed without ill effects. When placed in clear well water the majority of them died within six hours. In contrast with this only 30 per cent taken from clear water in the cleaner parts of the streams, where there was a fair surface current survived in the aquarium. During the rains they are taken in fair numbers from the rivers into which they are washed by the monsoon flood waters. Those in the streams are larvivorous and insectivorous. They feed greedily on the larvae of mosquitoes and midge flies and leap out of the water as much as ten inches high to take flying insects above the surface film. They also feed readily on algae and the flour of a millet grain called in the vernacular 'Bajri' but much prefer adult mosquito and midge flies.[1] The midge flies are seen in the characteristic clouds of their nuptial flight after the rains give over and during the cold months up to February. They appear in numbers at eventide and also at times during the day in flight above the streams. They are particularly in evidence above the stagnant sections and *Rasbora labiosa* and *Danio fraseri* then become very active leaping out for them. Several large specimens of *Rasbora labiosa* were taken on rod and line with a worm bait. One specimen, four inches in length, kept in the aquarium preferred a diet of worms, which it readily devoured and eschewed the larvae and imagos of the insect mentioned. One particularly large example of this species was netted in the act of swallowing a *Nemachilus*. This evidence would go to show that the smaller fry are insectivorous and when grown to adult proportions become carnivorous.

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[1] Mr. Prater in a letter states 'The midges which you sent from Deolali were identified in the British Museum as *Chironomus tripartitum* Rieff.'

In the publication 'Notes on Fishes in the Indian Museum, xxv. On two New Species of Cyprinid Fishes from Deolali' etc., —*Records of the Indian Museum,* vol. xxxvii, Part II, pp. 375-80, Hora and Mukerji emphasise the characteristic hypertrophy of the lower lip in *Rasbora labiosa* Mukerji and *Danio fraseri* Hora. In the absence of biological observation they found it difficult to assign any definite function to this structure, but directed attention to homologous structures found in certain tadpoles which are supposed to use the hypertrophied lip as a device for hanging from the surface film. They therefore think it is possible that the two new surface species also use the expanded lower lip for the mechanical process of suspending themselves from the surface film when the waters in their habitats become too foul for the ordinary process of respiration. With a view to ascertain whether they behaved in this way, observations were maintained over them and incidentally also over other surface and ground species for a period of five months from 1st November 1935. In the previous notes under mortality incidence, no details were mentioned as to the behaviour of the fishes on the initial transference from their natural environment to the aquarium. The description of this behaviour was postponed for consideration here. The majority of the surface fishes, inclusive of the two new species observed, as also those of the Siluroid family and the ground fish *Garra mullya* (Sykes) (Bhil names: *Mallia* and *Kharandya*) when introduced into the aquarium and dependent upon their powers of adaptability manifest a marked respiratory embarrassment. This they show in the following way. As regards the surface species, the ill adapted rise to the surface and by muscular action alone in the act of swimming maintain themseves as if suspended from the surface film. At the same time the mouth movements in the act of breathing become considerably accelerated; the mouth itself is opened wider and the gill covers are seen to heave to aid respiration. All of these symptoms clearly show the dyspnœa to which they become subjected. In this respect all the fishes behaved alike and in no single instance was there any evidence to show that in this distressed condition they made use of the lower lip in a mechanical way to hang from the surface. Occasionally in the act of swimming the dorsal aspect of the head and sometimes the upper lip was pushed above the surface level, but never the lower lip. When at the surface, the position of the body in relation to the surface film forms angles of a varying degree according to the species. In the case of *Rasbora* the angle formed is roughly 30, of *Danio* 40, of *Barilius* 30, of *Barbus ticto* 60 and of the Siluroids 40 to 60 degrees. They continue to behave in the way described until a moribund phase ensues when they turn over on their backs and finally in a short space of time die. With regard to the ground species referred to above, the behaviour is different. They do not swim about at the surface; instead they remain clinging to the surface by muscular effort in a perpendicular position for half a minute or so and then sink back again, repeating the process until moribund and unable to do so any longer. While at the top this ground species produces a froth of bubbles. A similar behaviour, but in a much less active form than the exaggerated behaviour described above, has been observed as a normal daily feature amongst the surface fishes and is regularly resorted to by them as an evening exercise. This form of exercise is unattended by any mortality and will be later discussed in a separate note to follow. As a result of these observations it may be remarked that the hypertrophy of the lower lips and the upward projection of the mouths in the two new Deolali species rather appear to indicate a line of development consistent with their feeding habits. All the evidence gathered with regard to their habits and habitats clearly show that the younger forms of *Rasbora labiosa,* Mukerji are definitely insectivorous, while *Danio fraseri,* Hora is undoubtedly so, probably throughout its life. The rounder and longer bodies of *Rasbora labiosa* are admirably suited to leap out of the water (ten inches) in taking mosquitoes and midge flies which they never fail to secure once they rise. In contrast with them, *Danio fraseri* is unable to rise higher than 4 or 5 inches above the surface level possibly because of its flatter body and shorter length (the largest caught here has not exceeded 4 inches in length); but in this fish also the gripping quality of the lower enlarged lip is so convincing that it leaves no doubt that it is a specialization enabling it not only to seize insects, but also to hold them until back in the water again where it swallows them. I have repeatedly observed their unerring skill in catching insects both in the aquarium and in the streams. A small pocket electic torch fixed by wires and suspended above the open end of the aquarium with the bulb facing upwards furnishes a simple device which attracts numerous flies at sundown and the fish are then seen to perfection demonstrating their ability in rising and taking the flies they want. Undesirable insects, mistakenly seized, are rejected below the water line by a process of blowing them out from the mouth, and in this act the protraction of the lower lip is markedly noticeable. The stagnant pools obviously offer better breeding facilities and attract many insects and the presence of these fishes in such habitats is so explained. One sees a similar upward formation of the mouth in the species of Chilwa—*Chela clupeoides* (Bloch) [Bhil name, *Jhal*]—which is also insectivorous, but the mouth in this species is large and capacious and hence perhaps the need for the development of the lower lip has not arisen as in the case of the two new species, which are comparatively smaller than other Cyprinoids which live on insects, and therefore need some such specialization in a small mouth to ensure success. It may be that certain tadpoles use the hypertrophied lower lip in a mechanical way to aid respiration. Their breathing apparatus in the transitional development from purely aquatic to terrestrial life probably, at a certain advanced stage, allows for breathing in air directly. In the case of the two new Deolali Cyprinoid fishes there is no evidence that they at any time use their enlarged lower lips to hang in a mechanical way from the surface film to aid respiration. On the other hand there is convincing evidence that they have a capacity for living in the foulest of waters without ill effects[1] and the smaller forms of this species that do so are definitely larvivorous and insectivorous as the stagnant habitats attract numerous insects and ensure a varied and plentiful food supply. The very young ones of both the new species are unable to swallow the larger Culicine larvae but easily devour the smaller Anopheline larvae and those of midges. These very young fishes were recovered during November. Egg-bearing females were found in February.

Barbus khudree Sykes—Bhil name, *Warris.*

This fish has two pairs of barbels. It is silvery white and slightly discoloured dorsally. It favours strong currents in the rivers. It does not live for more than half an hour in a receptacle of water. On this account no observations could be made.

Barbus ticto (Ham.).—Bhil name, *Tiptoo* and *Tiplee.*

This surface species appears to be the dominant type in the rivers. They are localised in sections having villages situated directly upon the banks and here they are very numerous, particularly if the village is a large one with a big population. They are found only in those parts of the tributary streams which run through largely populated areas, such as in the 'North Nallah' up to a point near to Deolali Cantonment Bazaar and the 'Narsullah Wadi' near to the village of Bagoor, and the section which runs through Barnes High School estate, where they are found in relatively small numbers. They are singularly absent in the stretches of both the rivers and streams which meander through open country or tracts given over to cultivation and where there is a complete absence of human habitations. In sections of these open stretches where there is an occasional hamlet or two, they can be got, but only in very few numbers. They favour the shallow edges of the rivers up to a depth of two feet, where the currents are of slight intensity. In the streams they favour stagnant pools or those with a slight surface flow. All the specimens of this species taken from the Godaveri river on 8th December 1935 (batch No. 28) and from the Narsullah Wadi on 19th January 1936 (Batch No. 35) showed a markedly scarlet pigmentation of the body scales; and the caudal, dorsal and ventral fins were similarly stained. On the 8th December 1935, the water in the Godaveri river was very dirty looking, ashen in colour and with green algae, largely in evidence, floating in fragments on the surface scum. Much of their red colouration has been lost through storage in spirits. In other areas, an occasional scarlet stained specimen was recovered. Normally they are silvery white and stained dorsally; with muddy coloured fins and black rays. When kept in an aquarium they lose all the dark staining becoming silvery white with very pale fins. They do not for the first week readily feed on the larvae of mosquitoes, but in the course of time and due to the absence of other food, ultimately become larvivorous. They then show much greediness. They also feed on green algae, the dough of any flour and ground particles of roasted 'Bajri' grain. Very young specimens were recovered from the streams during November 1935. Egg-bearing females were found in March 1936.

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[1] The surface water is, as a rule, better oxygenated, so the surface fishes do not in reality live in very foul waters. It seems also probable that the respiration is aided by taking in gulps of air, as most of the Cyprinoids do, and passing them over the gills.—*S. L. Hora.*

Garra mullya (Sykes).—Bhil name, *Mallia*.

The mouth of this species points downwards and there is a suction disc on the ventral aspect of the mouth. It is a very dark coloured fish with black fins and the suggestion of a lateral line, as the perforated scales are ill defined against the dark discolouration of the body. These lateral scales are complete. It is found in sections of the rivers and streams which flow over beds of rock. It favours fairly strong currents and depths. Although showing a degree of susceptibility, the species can live for 2 to 3 days in an aquarium. Their behaviour in the aquarium has been described in the previous notes under mortality rates. When lying on the floor of the aquarium the mouth movement in the act of respiration is at a slower rate than that of the surface fishes. They move along the floor with a leaping and wriggling movement. I have not been able to ascertain what they feed upon but since they favour a rocky bed the diet may be a form of algae growing on the rocks. They are generally distributed in both the rivers and streams. Egg-bearing females found in March 1936.

Labeo porcellus (Heckel).—Bhil name, *Khanoos*.

It favours sections of the rivers where there are fairly strong currents and the bed is rock or pebbled and part silted. It is dorsally an elephant grey and laterally and ventrally silvery white. The fins are dark coloured. As it does not survive when removed from its natural environment, no observations could be made.

Cobitidae

Nemachilus botius (Ham.).—Bhil name, *Mohroo chickna,* is a leopard spotted variety. The colouration is a yellow background with black spots and bars and dark yellow fins. *Mohroo chopra* [*Lepidocephalichthys guntea* (Ham.)] is a dark coloured fish with dorsal spots and mottling with a clear black line. It is very thin and attenuated in form. *Mohroo yaree* [*Nemachilus denisonii* (Day)] is a banded variety. The bands are dark and broad and run transversely from the dorsal ridge to the ventral surface.

Mohroo thail resembles in colour *chopra* but the tones are much lighter and it is definitely stouter and heavier in formation.

The Cobitidae are found generally distributed in rivers and streams. They favour the rocky sections and silted and sanded beds where there is evidence of algae growing from the rocks and sides of the rivers. The banded variety, namely *Mohroo yaree,* is more numerous and associated with *Rasbora labiosa* Mukerji at the heads of the streams. They hug the edges of the rivers and the streams where the currents are not too strong.

Lepidocephalichthys not only move their lips in the act of breathing but also rise to the surface to take in air. They do this about 12 to 15 times in an hour. They feed well on green algae growths especially the variety which grows on and clings to rocks. When kept with other surface fishes which were fed on the larvae of mosquitoes they were observed in the act of swallowing the larvae. A curious trait noticed is their habit of mouthing the bodies of surface fishes, when these latter were resting stationary a little above the floor of the aquarium. The surface fishes do not resent this action. They are also fond of pushing themselves up the glass surface of the panel, nibbling, as they move, particularly when the panel is covered with a scum of fine earthy particles and slime. These species move along the bottom of the aquarium with a wriggling motion much like a snake and can cling to and climb up an almost upright glass panel. In this respect they show undoubted scansorial powers.

Mystus cavasius (Ham.).—Bhil name, *Khirkirya.*

This cat fish has proved to be a good aquarium fish. They behave much in the same way as surface fish do and regularly exercise themselves by swimming at the surface every evening. During the day they rest at the bottom of the aquarium all huddled together but show the greatest activity at night. They are silvery with a greenish tinge and the fins are light in colour. They feed readily on mosquito larvae and also on worms which they prefer. They are able to move the eye forwards, upwards and downwards. They are susceptible to strong sunlight and show a photophobia and strive to conceal the head by efforts to get under each other or, if there is algae in the water they hide in them. They favour sections of the rivers which have a broad expanse and where the bed is rocky and part silted and are found at the edges at depths up to three feet in currents of mild intensity.

Glyptothorax lonah (Sykes).—Bhil name, *Khardoo.*

It bears a close resemblance to the *Goonch.* When freshly caught and alive, the colour was strikingly beautiful. It lived for barely fifteen minutes and lost colour through storage in preservatives. Originally the post-mortem white markings were a bright red both on the body and the fins and belly and the dark background now seen was a jet black colour.

Nangra viridescens (Ham.).—Bhil name, *Biboa.*

When freshly caught, the colour was a rich gold with some black dorsal markings. They lived for only a half hour and were taken from the Aounda and Darna rivers. It is a recessive type as only a very few were taken.

Ophicephalidae:—There are two species with the following Bhil name :—(1) *Dhakay* or *Dhakaray* (*Ophicephalus gachua* Ham.) is a black fish with the terminal ends of the caudal fins stained a brick red, which fades in preservatives; (2) *Murral* (*Ophicephalus marulius* Ham.):—Dorsally and laterally greenish brown. Ventrally white and a well-defined ocellus superiorly placed upon the caudal fin.

Both species make good aquarium fishes but they are unsociable and attack and kill each other and hence cannot be left together. Both can be kept with other species provided they are regularly fed with worms and bits of meat (raw). If hungry they devour the smaller surface species. They appear to be nocturnal in habit as they then manifest the greatest activity by endeavouring to leap out of the aquarium. One kept in a jar by itself succeeded one night in getting out of it. This it must have done at some time after eleven o'clock, when the fishes in the aquarium and those in other receptacles had been inspected by me before retiring for the night. I found this *Dhakay* specimen at six o'clock next morning on the floor to all intents apparently dead. Its skin was dry and hard as a board and the only evidence of life it showed was the fitful movement of one of the forward fins. I placed it in water and it slowly recovered taking in all six hours before regaining its normal state. *Dhakay* are found everywhere both in the rivers and streams. The other species has been taken only from rivers and is also found at the junctions of the streams with the rivers. Both species hug the edges at depths up to two feet and prefer silted areas grown with aquatic vegetation. In the aquarium both rise to the surface to take in air about fifteen times in an hour and always sink back tail first to the floor. They do not normally, when at rest, work the mouth in the act of breathing, but do so only when exercised or under stress of excitement as when engaged in chasing, biting and killing each other. In the absence of the food mentioned they readily swallow the larvae of mosquitoes.

Glossogobius giuris (Ham.).—Bhil name, *Kharbiya.*

Dun or olive coloured background, varying in shade with dark spots laterally and dorsally in the nature of blotches and also on the head.

Kharbiya have been taken from sections where the bed is rock or sand and appear to favour strong currents. Curiously enough they work the mouth in the act of respiration at a slightly slower rate than that of the surface species. They are capable of living in the aquarium for 4 to 5 days only and this inadaptability can be attributed to the absence of currents. I have not been able to ascertain what they feed upon. In all probability their food consists of small crustaceans.

3. A Note on the Fixed Practice as Observed Amongst Certain Species of Fish of Regularly Exercising Themselves every Evening by Swimming about at the Surface Film in the Rivers and Also when Kept in an Aquarium.

The following species were observed for five months. They were kept in large-sized glass receptacles (accumulator jars) which had a surface expanse of 22 inches and a depth of 18 inches of water (approximately six gallons) in each. Other containers such as slop pails (Enamel iron) of four-gallon capacity were also used. About a dozen and a half fishes were kept in each of these containers for which net covers were provided. The species are as follows:—

(1) *Barbus ticto* (Ham.):—Bhil name: *Tiptoo*
(2) *Rasbora labiosa* Mukerji:—Bhil name: *Gayroonjee*
(3) *Danio fraseri* Hora:—Bhil name: *Gayroonjee*

(4) *Barilius bendelisis Ham.* :—Bhil name : *Jhor*
(5) *Mystus cavasius* (Ham.) :—Bhil name : *Khirkirya*
(6) *Ambassis ranga* (Ham.) :—Bhil name : *Bing*
(7) *Ophicephalus marulius* Ham. :—Bhil name : *Murral*
(8) *Glossogobius giuris* (Ham.) :—Bhil name : *Kharbiya*
(9) *Ophicephalus gachua* (Ham.) :—Bhil name : *Dhakay*
(10) *Garra mullya* (Sykes) :—Bhil name : *Kharandya* and *Mallia*

Excepting (6), (7), (8), (9) and (10), in the aquarium, the first five species, regularly every evening for about two hours between 4.30 and 8.30 p.m. rose to the surface to exercise themselves in much the same manner as has been described under the habits of *Rasbora labiosa* Mukerji. This form of exercises is unattended by any mortality and the fishes do not show any symptoms of dyspnœa. There is evidence also that other surface fishes belonging to the family *Cyprinidae* carry out this practice as a regular feature every evening in the rivers, but as most of those taken from rivers invariably showed a high degree of susceptibility to aquarium conditions, with a cent per cent. mortality incidence, it was found impossible to discover how many of the various species conformed to this practice. It may be remarked that in a general way it is a habit prevailing amongst the majority of surface fishes and at first, it was thought that only such species as are purely insectivorous rise to the surface and swim about in order to feed. This was however later disproved by the observations which were maintained in the aquarium over the five species already mentioned. All resorted to the practice at the regular time even when they had been fed to surfeitment with larvae and imago of mosquitoes and midge flies from 2 to 4 p.m.[1] This experiment was repeated daily for many months and the fed series showed no deviation from the rule, as they instinctively responded to the urge at the regular time as usual without evincing any desire for food although the opportunities offered. The control series which were sparingly fed combined the exercise with attempts to feed by devouring larvae and leaping to take the insects flying above the water level. This evidence led to the consideration that, as the exercise appeared to be a purposive act not specifically associated with hunger, there was some other physiological cause underlying and governing this peculiar behaviour. What this cause may be is, of course, a matter for conjecture. The following notes outline the line of investigations which was followed in an endeavour to find a solution for this enigmatical behaviour of surface fishes and from the facts obtained by experiment and observation a working hypothesis is offered which might possibly help other workers competent to deal with and solve the problem.

It was thought that variations in the temperature of water at various times of the day and evening possibly influenced the fishes to act in the way they do and so an inquiry in this direction was instituted and extended over a period of several months. These temperature differences will be found recorded subsequently. It may be remarked that, in a general way, the variations in the temperature of the water in the rivers and in the aquarium do not appear directly to influence the behaviour of the fishes as regards their evening exercise. The surface species in the rivers were sometimes seen to rise and swim about at the surface during the mornings and, on occasions, also in the afternoons; but they do this only when a high prevailing wind ruffles the surface and beats it into wavelets. On these occasions it is evident that they come up to the surface actuated by a desire to feed as the wind brings with it a supply of insects for which they actively leap out above the surface film. They nevertheless rise as usual in the evening and go through with their exercise whether a wind is blowing or not. During the dry and hot months of the year—April for example, when the maximum shade temperatures swing between 98° and 106° F.—the temperature of the surrounding air varies and is 5 to 20 degrees higher than the temperature of the water in the rivers; whereas during the cold months (December and January) the temperature conditions are reversed and the air is then colder by about 4 to 20 degrees. In the cold months, a constant feature recorded was that there was a surface coolness of the water in the rivers and also in the aquarium of one degree as compared with that in the depths below. The temperature in the deep parts of the river was ascertained by means of a weighted thermos flask containing a bath thermometer and two open tubes, one running from outside through the stopper to near the bottom of the flask for entry of water and the other ending just under the stopper to let the air out. During the hot weather a surface coolness of half a degree becomes apparent but only at a time when there is a prevailing wind and only in the sections of the river where there is a wide surface expanse with a weak midstream current. In the absence of a wind, there is no difference between the temperature at the surface to that in the depths below and this is also the case in the sheltered pools and narrow parts of the stream and rivers. In the aquarium likewise, there is no difference between the surface temperature and that below in the depths unless the receptacle is well ventilated and placed in a position open to draughts of air and even then the coolness is barely fractional. When the receptacle contains clear well-water, subject to daily changes, the fishes rise and swim about at the surface only once daily every evening for about two hours. This they do apparently quite independently of the temperature conditions, which in the cold weather vary from 56° to 86° and in the hot weather from 74 to 96°F. On the other hand, if the water in the receptacle is rendered turbid with a heavy suspension of mud the fishes rise and swim about at the surface and begin to show some respiratory embarrassment. A few die if the suspension of mud is too thick. They continue to keep at the surface for as long as the water remains muddy. When the mud finally subsides they sink below once again. In such a water they tend to keep towards the surface film as the supernatant fluid is generally clearer and less difficulty in respiration is experienced. When the evening hour arrives they begin the exercise as usual.

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[1] My observation and experience with numerous species of *Cyprinidae* in China and the Philippines is that this peculiar practice is a regular feature in the early morning, from before 6 o'clock until 7 or 7.30 a.m. or until the sun's rays strike the water. The fishes swim at the surface, opening and closing the mouths as if sucking in air.—*Albert W. C. T. Herre.*

A striking fact which emerged from the observations is that when the fishes in the receptacle have exercised themselves in the manner described for an hour or so, patches of frothy bubbles are noticed floating or clinging to the sides of the glass panel and these frothy bubbles were absent prior to the exercise. This is a constant feature but it could not be ascertained whether the fishes give out these bubbles or whether they become created mechanically by them in the act of vigorously swimming at the surface. As the appearance of the bubbles is a phase dependent upon the peculiar exercise of the fishes, there is a definite association between the two, and for this reason it would seem that the fishes themselves emit a gaseous discharge while in the act of swimming and this must come from the mouth in the form of tiny invisible particles which, when at the top, coalesce to form the larger visible bubbles normally seen. In the aquarium these bubbles take a very long time before being finally dissipated as some of the floating patches remain intact until the next morning. In the case of the batch of *Rasbora labiosā* Mukerji, referred to in the previous notes, kept for eleven weeks in the same foul water which was never changed, the bubbles in their receptacle accumulated and assumed large proportions and had the character of the frothy saliva seen issuing from the mouths of rabid dogs. The gas, whatever it be, is enclosed in a viscid mucous substance which does not burst readily.

All fishes in the aquarium rise to the surface when symptoms of respiratory failure ensue and this must be so because of the absence of some of the factors of their natural environment, the chief one of which is the amount of available oxygen in the water in the form of dissolved air, which judging from their behaviour appears to be present in a greater volume at the surface. It is well known that if the air which is dissolved in water be expelled from it, the content of nitrogen in this expelled air is in poorer volume in the proportion of 35.1 oxygen and 64.9 per cent. nitrogen as compared with normal air which has 21 volumes of oxygen and 79 of nitrogen and in all probability the lesser pressure at the surface must also help the fishes to easily absorb both the gases. It is possibly for this reason that the Cyprinoid fishes rise to the surface.

[It has hitherto been casually observed to be a general habit among Indian Cyprinoid fishes of sluggish waters, such as rivers, streams, ponds and pools, to rise to the surface towards the evening and to take gulps of atmospheric air, which is usually passed over the gills. Dr. Fraser's observations show that this is a regular habit among the fishes of this class. Presumably, the passing of the air over the gills tones up the filaments to carry on aquatic respiration for the greater part of the day and night, as Cyprinoids are essentially aquatic breathers.

Dr. Fraser has noticed that frothy bubbles are given out by these fishes and that these bubbles are very sticky. The air which is passed over the gills, which are always covered with a thick slimy secretion, probably carries away with it a certain amount of slime which converts the air-bubbles into a frothy mass. When experimenting with the air-breathing fishes, which use their gills for aërial respiration, such as the *Mastacembellidae* (*Trans. Nat. Inst. Sci. India*, i, p. 8, 1935), it was noticed that a big frothy mass was produced by the air-bubbles that were given out through the gill-openings. To my mind, Dr. Fraser's observations clearly show that the Cyprinidae resort to aerial respiration for a couple of hours in the evening each day.

As to why the other species of fish enumerated by Dr. Fraser in this note do not swim near the surface in the same way as the Cyprinoids do, the explanation is different for different species. *Ambassis ranga* (Ham.) is very thin and transparent and can probably absorb oxygen all over the surface. *Ophicephalus marulius* (Ham.) and *O. gachua* (Ham.) are provided with special accessory respiratory chambers and are even capable of living in waters totally deficient in oxygen. *Glossogobius giuris* (Ham.) is only slightly adapted to foul-water conditions, but presumably its large gill areas are capable of absorbing a fair amount of oxygen from the water and, unless the water becomes very foul, the fish can extract sufficient oxygen from the water for its needs. Further it is known that species of fish can extract oxygen from water even when the oxygen-tension is very low for a number of normal aquatic breathing fishes.—*S. L. Hora.*]

4. Temperature Variations and Alkalinity of the Water.

Temperature.

Temperatures were taken by means of an ordinary bath thermometer and records were maintained over a period of seven months from November 1935 to May 1936 inclusive. Altogether a total of 315 observations were made in the streams and 330 in the rivers. These totals represent an average of 45 readings taken during any one month, that is, of four registrations made at 6 a.m., 2 p.m., 6 p.m. and once at between the hours from 9 p.m. to 1 a.m. on 12 different days in any one month, which for all practical purposes gives a rough idea of the diurnal ranges of temperature of the water in the rivers and streams in the Deolali area at two seasons, namely:—the cold months from November to February and the hot season from March to May inclusive. Only a few readings were taken at the end of the monsoon period of 1935 and as these records are really in the nature of incomplete data they have not been included in the totals shown above.

These records are shown in the following table:—

During the cold months:—November to February.

	Streams.	Rivers.	Aquarium.	Air.
By Day	60 to 80°F.	66 to 86°F.	66 to 76°F.	50 to 70°F.
By Night	56 to 68°F.	62 to 72°F.	56 to 70°F.	40 to 60°F.

During the hot months:—March to April.

	Streams.	Rivers.	Aquarium.	Air.
By Day	80 to 96°F.	76 to 86°F.	78 to 86°F.	90 to 108°F.
By Night	74 to 82°F.	72 to 76°F.	74 to 78°F.	82 to 92°F.

From the above figures it will be observed that during the cold weather the water in the rivers is slightly warmer than that in the streams. This warmth may be due to the presence of very strong currents, as the temperature of water which rushes strongly was found to be, dependant upon the strength of flow, higher by 2 to 4 degrees than the water in a still pool or that in a stream with a mild surface flow. Conversely during the hot weather, the streams are warmer than the rivers. This can be accounted for by the fact that in the dry weather there is much less water in the channels of the streams and there is little or no flow which results in a fair degree of stagnation. Some portions of the stream dry up also and the collections of water in the rocky sections of the *Nallahs* become heated.

Surface temperatures of water: It was found that during the cold weather there was a surface coolness of half to one degree as compared with the temperature below in the depths. In the hot weather the temperature both at the surface and below was identical except when a strong breeze was blowing and ruffling the water's surface when a slight fractional coolness was noted.

Differences between the air and water temperatures during the hot and cold seasons of the year: The peculiarities observed were that during the cold weather the air temperature is lower than that of the water in rivers and streams and aquarium by 4 to 20 degrees and it is higher in the hot months by 5 to 20 degrees. In this connection the few observations made during the rainy season showed that both air and water temperatures appeared to vary little and were fairly constant showing a diurnal range of 65 to 74°F.

Reactions of fishes to extremes of water temperature: It was found that the range of water temperature which conduced to a normal activity amongst fishes as depicted by their behaviour was from 65 to 80°F. Any temperature below 58°F. inactivated them as they then tended to remain at the bottom all huddled together and, if green algae are present in the water, they push themselves into its meshy texture. On the other hand a temperature above 84°F. caused them to exhibit a restlessness in the form of an activity confined to swimming about just below the surface film and in doing this they showed an accelerated breathing rate, but with no signs of actual distress. At temperatures above 90°F. symptoms of acute dyspnœa became manifest.

The following experiments were carried out with a view to ascertain the end points of extremes of water temperature which kill fishes and the tolerance of any acquired for heat and cold. The same number of fishes, previously enumerated were employed in these experiments, namely 10 species belonging to both surface and ground types.

(1) The temperature of the water in the receptacle containing these species was gradually lowered by placing blocks of ice around it. By this means it was ascertained that during the cold weather the minimum temperature which killed both surface and ground species is 48 to 50°F. Conversely (2) also during the cold weather, by heating the receptacle in a water bath the maximum temperature at which fishes died stood at between 92 to 94°F. On the other hand similar experiments carried out during the hot weather showed that the minimum temperature at which fishes became moribund and died was 55 to 58°F. and the maximum at between 102 to 104°F. These experiments clearly showed that fishes at the different seasons acquire or lose a tolerance for heat and cold.

How far the temperature variations of the water at the different seasons influence the distribution of the species as betwen the rivers and streams cannot be precisely determined but there is evidence to show that the constancy of water temperatures as has been shown to obtain in the rivers may be a factor controlling the distribution, as the variations of the temperature in the waters of the rivers is within the limits of tolerance for the well-being of fishes and the majority of the species found here have their habitat in the rivers. In this connection it may be remarked that the other factors which play an important part in regulating the distribution of the species are (1) Alkalinity of the waters (2) The presence of strong currents (3) The greater volume of water and the wide surface expanse which so far as the rivers are concerned offer to fishes a better environment than that in the streams. I have previously mentioned that there are only three species which can be regarded as truly stream fishes. Two of these are surface species and curiously enough are quite new Cyprinids described by Hora and Mukerji in the *Records of the Indian Museum,* namely :—*Danio* (*Danio*) *fraseri* Hora and *Rasbora labiosa* Mukerji and the other is a ground species with the Bhil name of 'Kharandya' [*Garra mullya* (Sykes)]. There is enough evidence in the collection made of these species that the adults never attain any large dimensions. In the case of river fishes, with but few exceptions the majority grow to a large size. Judged on this evidence it is apparent that the stream environment is unfavourable to fishes generally and the three species mentioned can be regarded as classic examples of fishes which have completely adapted themselves.

Alkalinity.

This was tested by means of red and blue litmus papers reactions. By this test the water in the streams was found to be more alkaline than river water. Well water was slightly less alkaline than either river or stream water. In certain sections of the streams and rivers, where there was an absence of currents, the water was found to be strongly alkaline especially in those areas which were silted up. In some parts of the rivers the reaction was neutral. In no instance did either river or stream water give an acid reaction.

As regards the pH values, crude water from the river tested at the Military Laboratory, Bombay, was found to have the pH standing at 8. Reaction alkaline, turbidity present, free ammonia in a trace. Hardness under 4 degrees. Chlorides 2 parts chlorine per 100,000.

In a slightly acidulated water stream fishes will live for $\frac{1}{2}$ to 1 hour. In distilled water with a neutral reaction stream fishes lived for 3 to 6 hours.

In tap water boiled and cooled and giving a neutral reaction stream fishes showed no distress and lived for several weeks without the water being changed, nor did they die when restored to an alkaline water taken from a well.

Mention may be made of the fact that *Barilius bendelisis* (Bhil name 'Jhor') was found in somewhat brackish waters. It would appear that a slightly alkaline water suffices for the majority of the fishes in the streams and rivers in the Deolali area.

5. Miscellaneous Notes.

Sleeping habit of the Ophicephalidae.

The two species of fish known to Bhils by the names of *Dhakay* (*Ophicephalus gachua* Ham.) and *Murral* (*Ophicephalus marulius* Ham.) I have been told by Bhil fishermen, have the habit of sleeping on the banks all night. They lie up in the shallows at the edges of the river with their heads partly exposed and this helps them to take air while asleep. There is a good deal of truth in what they say as these species, when in captivity in the aquarium, exhibit a nocturnal activity by endeavouring to leap out of their receptacles and this anxiety would naturally be prompted by the break in the continuity of the habit of resting and sleeping in the way described by the Bhils.

Malformations.

As regards malformations in the body of fishes, there is one specimen of *Rasbora labiosa* Mukerji (Bhil name: *Gayroonjee*) which is of considerable interest as there are several twists in its body length. This specimen when alive behaved quite normally except for a handicap in its swimming speed. The speed was half that of the other normal examples of its species. Another exhibited a tumour-like growth (much like a Goiter enlargement) on the ventral aspect below the mouth. This is important because I have not encountered any malformations in the many specimens of various species taken from the rivers.

Vernacular Names.

The names by which Bhil fishermen differentiate the various species have been cited in the previous notes. They give separate single names to species of the Cyprinoidea, Siluroidea and Ophicephalidae families and in certain examples for some unknown reason assign only one group name to include two or more different species despite the fact that they know them to be distinct types. Only in one case that of the Loaches (*Cobitidae*), do they attempt to separate out the species by employing the group or family word conjoined with another colloquialism to denote the type. I have collected specimens under the names as they were given to me and in this series it will be found that the same names recur for different species. In order to be quite sure that there was a general uniformity amongst the Bhil fishermen in the naming of fishes I obtained information from several fishermen residing in villages as far apart as 20 miles and in each case the vernacular names given by them agreed.

Note on a predaceous Water-Beetle which kills stream fishes.

Roughly 2 per cent. of fishes secured from the tributary streams had a small aquatic beetle attached to them near the gill aperture. By keeping eleven of these beetles separately in receptacles along with a dozen or more of stream fishes of the following species: *Rasbora labiosa* Mukerji, *Danio fraseri* Hora (Bhil names:—*Gayroonjee*) and *Barbus ticto* (Ham.)—(Bhil name:—*Tiptoo* or *Tiplee*), it was observed that a single beetle killed on an average a dozen of these fishes in the course of 3 to 4 days. They do this by attaching themselves to the gill aperture towards its upper margin and the fish attacked in this way becomes moribund and dies in a matter of 30 to 35 minutes in the case of *Barbus ticto* and up to one hour for the other species mentioned. In the initial attachment of the beetle the fish endeavours to rid itself of the pest by vigorously swimming about in a frenzied manner. This exercise soon tires the fish and the breathing rate becomes accelerated. It then rises to the surface film where it continues to actively move around for 10 to 15 minutes after which the swimming pace is gradually slowed down and at this stage it begins to wobble about and shows much dyspnœa. During this time the beetle without releasing its hold manages, by raising its tail above the surface level of the water, to take air in the form of a bubble into the hind end beneath the elytra. About 8 to 10 minutes after the death of the fish the beetle releases its hold and swims free once again. The death of the fish is apparently brought about by the beetle draining it of blood. The beetles do not eat away the soft parts below the gill covers, which on examination appeared intact. Curiously enough, three of the series of eleven beetles did not kill fishes, although they were left with fishes for the same time period of one week as in the case of the eight beetles which did. The reason for removing the beetles after one week was because those which killed fishes ceased to do so after they had accounted for a certain number—the minimum was 9 and the maximum 14 with an average of 12. On the cessation of the killing operations, the eight beetles without exception made determined efforts to fly out of the aquarium. In contrast with this behaviour those that did not kill evinced no such desire and behaved quite normally by remaining under water and rising to the surface every 2 minutes or so to take the air required for their purpose. These eleven beetles were subsequently killed and examined. Those that killed fishes in the aquarium and also the number which were found attached to fishes recovered from the streams were all females. Of the three which did not attack fishes, two were males and one a female—the male, as is usual with aquatic Coleoptera, is distinguished by a disc-like structure placed on the forepart of the anterior pair of legs. These beetles were not observed in copulation. It may be here remarked that the original observations began with 15 beetles, 4 of these, after killing fishes, escaped during the night from the aquarium and were never seen again.

I have no literature on the subject of beetles and am therefore unable to identify the species under reference. Altogether 4 distinct species of aquatic beetles were recovered from the tributary streams and stagnant sections of the rivers in the Deolali area. They all definitely belong to the Pentamera group of Coleoptera as they all show the tarsus with five joints on each of the three pairs of legs and they therefore fall into the main family *Hydradephaga*. One of these species is a black beetle and as it swims only on the water surface and is possessed of short antennae it therefore in all probability belongs to the sub-family *Gyrinidae*. A second species also possessed of short antennae with a greenish black hue appears to belong to the sub-family *Hydrophilidae*. The remaining two fall into the sub-family *Dytiscidae*. One of these is a giant species measuring 4 cm. in length. The other—the particular species under reference in this note—is very small, being only 1.3 cm. in length and 0.6 cm. broad. Both these species have long antennae with eleven segments. The larger of the two is brownish black in colour with the edge of the wing case lined in red. The smaller beetle has a straw-coloured background with some linear black blotches on either side of the wing cases. Specimens of this small beetle have been sent to the Bombay Natural History Society, Bombay, for identification. As regards the giant and other water-beetles mentioned in this note, there was no evidence to bear that they kill fishes.

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I am greatly indebted to Dr. S. L. Hora of the Zoological Survey of India for revising the manuscript copy of the foregoing notes and gratefully appreciate and thank him for his courtesy and kindness in having named after me one of the two new Cyprinid Fishes from Deolali, described by him in the *Records of the Indian Museum,* vol. xxxvii, Part ii, pp. 375-80.

My warmest thanks are due to Mr. S. H. Prater, Curator, Bombay Natural History Society, who has helped and encouraged me throughout with valuable suggestions and advice.

(*To be continued*).

THE MEDICINAL AND POISONOUS CROWFOOTS OF INDIA.

By

J. F. Caius, s.j., f.l.s.

The Ranunculaceæ are annual or perennial herbs, rarely shrubs or climbers. The family includes 40 genera with about 700 species, distributed all over the world, abundant in temperate and cold regions, rare in the tropics and usually at high altitudes.

This is a very important family from our point of view, as owing to the fact that a poisonous, acrid, and narcotic principle prevails in varying degree throughout the Order, there is scarcely one plant which can be regarded as harmless, while some are deadly. However, most crowfoots lose their acrid qualities on drying or cooking. Their roots, when perennial, contain, besides the acrid, a bitter extractive principle, present in various proportions, with a volatile oil, which render them drastic and emetic. Their seeds are acrid; some contain both a fixed and a volatile oil, and are aromatic.

The various members which have been chemically examined have been found to contain (1) *alkaloids*—aconitine, ajacine, ajaconine, atisine, benzaconine, berberine, bikhaconitine, canadine, clematine, coptine, cynoctodine, damascenine, delcosine, delphinine, delphinoidine, delphisine, deltaline, hydrastine, indaconitine, isopyrine, japaconitine, jervine, jesaconitine, lappaconitine, lycaconitine, myoctonine, neopelline, palmatisine, pseudaconitine, septentrionaline, staphisagroine—; (2) *volatile acrid and bitter principles*—anemonin, cimicifugin, nigellin—; (3) *acids*—aconitic, anemonic, isoferulic, valerianic—; (4) *crystalline or amorphous glucosides*—adonidin, delphinin, helleborein, helleborin, paeonin—; (5) *saponins, tannins, resins, oleoresins, sugars* and *fats*.

The better known medicinal and poisonous crowfoots of the world belong to the following 24 genera:—Aconitum (Northern temperate regions); Actaea (Northern temperate regions); Adonis (Northern palaeotemperate regions); Anemone (cosmopolitan); Aquilegia (Northern temperate regions); Caltha (temperate regions); Cimicifuga (Northern temperate regions); Clematis (cosmopolitan); Clematopsis (Nigeria, Tanganyika, Congo, Angola); Coptis (Northern temperate and arctic regions); Delphinium (Northern temperate regions); Eranthis (Northern palaeotemperate regions); Helleborus (Europe; Mediterranean region); Hydrastis (Japan; North America); Isopyrum (Europe, Asia, North America); Knowltonia (South Africa); Myosurus (temperate regions); Nigella (Europe; Mediterranean region); Paeonia (Europe; Asia; western North America); Pulsatilla (Central Europe; Siberia; East Indies); Ranunculus (cosmopolitan); Thalictrum (Northern temperate regions); Trollius (Northern temperate and arctic regions); Zanthorhiza (Atlantic North America).

The medicinal and poisonous crowfoots of India belong to the following 14 genera:—Aconitum, Actaea, Adonis, Anemone, Aquilegia, Caltha, Cimicifuga, Clematis, Coptis, Delphinium, Nigella, Paeonia, Ranunculus, Thalictrum.

A. Erect or climbing shrubs. Leaves opposite. Sepals petaloid, valvate. Carpels 1-ovuled; ovule pendulous. Fruit of many achenes
  Petals 0 ... ... Clematis.

B. Herbs. Leaves radical or alternate. Sepals petaloid, imbricate. Carpels 1-ovuled; ovule pendulous. Fruit of many achenes
  I. Petals 0, flowers involucrate ... ... Anemone.
  II. Petals 0, flowers not involucrate ... ... Thalictrum.
  III. Petals 5-16, with no nectariferous pit ... ... Adonis.

C. Herbs. Leaves radical or alternate. Sepals herbaceous, imbricate. Carpels 1-ovuled; ovules erect. Fruit of many achenes
  Sepals 3-5, deciduous, petals usually 5 ... ... Ranunculus.

D. Herbs or undershrubs. Leaves alternate. Sepals petaloid or herbaceous, imbricate. Carpels several, many-ovuled. Fruit of 1 or more follicles (berried in Actaea)
  I. Flowers regular solitary or panicled
    a. Petals 0. Leaves undivided ... ... Caltha.
    b. Petals small, carpels long-stalked ... ... Coptis.
    c. Petals small, unguiculate. Carpels sessile. Flowers pale blue ... ... Nigella.
    d. Petals as large as the sepals, all spurred ... Aquilegia.
  II. Flowers regular, racemed
    a. Carpels solitary, berried when ripe ... Actaea.
    b. Carpels 4-8, follicular when ripe ... Cimicifuga.
  III. Flowers irregular
    a. Posterior sepal spurred ... ... Delphinium.
    b. Posterior sepal vaulted ... ... Aconitum.

E. Herbs or undershrubs. Sepals herbaceous imbricate. Carpels several, several-ovuled, girt by a fleshy disk. Fruit of coriaceous few-seeded follicles ... ... Paeonia.

Aconitum.

The genus numbers 110 species distributed over the northern temperate regions of the globe.

Aconites are at once highly poisonous and most valuable medicinal plants. The following species are used medicinally in Europe—*A. Anthora* Linn., *A. Cammarum* Linn., *A. Lycoctonum* Linn., *A. Napellus* Linn., *A. variegatum* Linn.—; in Japan and China—*A. Fischeri* Reichb., *A. Lycoctonum* Linn., *A. Napellus* Linn., *A. uncinatum* Linn.—; in North America—*A. Fischeri* Reichb., *A. Napellus* Linn., *A uncinatum* Linn.—; in Indo-China—*A. Fischeri* Reichb., *A. Kusnezoffii* Reichb., *A. Lycoctonum* Linn., *A. Napellus* Linn.

Those aconite alkaloids which have been fully examined belong to two well-defined groups:—(1) aconitines, which are highly poisonous—aconitine and bikhaconitine from *A. Napellus,* indaconitine from *A. chasmanthum,* japaconitine from Japanese hondo aconite roots, pseudaconitine from *A. deinorrhizum* and *A. Balfourii,* jesaconitine from Japanese bushi aconite roots, lappaconitine and lycaconitine from *A. Lycoctonum*— ; (2) atisines, which are not toxic —atisine from *A. heterophyllum,* palmatisine from *A. palmatum.*

Nothing is known of the properties and uses of 11 species recognized as Indian. The other 13 Indian Aconites are arranged according to the structure of their roots, on the authority of Stapf:—

A. Root perennial, long, fusiform usually breaking up at length into cord-like anastomosing or free strands; old plants often with several stems from the collar ... 1. *A. luridum.*

B. Roots biennial, paired, tuberous; each tuber producing normally one simple or rarely branched stem

I. Stem erect, rarely ascending, never twining

1. Seed-angles winged, faces smooth or almost so (not transversely lamellate)

a. All the leaves distinctly to very long-petioled, cordate-orbicular or reniform in outline, deeply dissected

i. Tubers 2-3.5 cm. long, fracture in the dry state horny or cartilaginous, brown (at least the part outside the cambium); taste slightly bitter, followed by a tingling sensation; carpels 5, glabrous or nearly so, never tomentose ... ... 2. *A. chasmanthum*

ii. Tubers 0.5-2.5 cm. long, fracture in the dry state almost farinaceous, pure white; taste indifferent or slightly sweetish, not followed by any tingling sensation; carpels densely tomentose; honey-gland subterminal ... ... 3. *A. violaceum.*

b. All the leaves with the exception of the lowest shortly petioled to sub-sessile, cordate-ovate, coarsely crenate ... ... 4. *A. heterophyllum*

2. Seeds with hyaline wavy transverse lamellae

a. Cambium of tubers discontinuous, forming in cross-section circular or tangentially flattened to horseshoe-shaped strands

i. Nectary-hood very slender with a minute lip; carpels quite glabrous; taste of tubers intensely and pure bitter, not followed by any tingling sensation ... 5. *A. palmatum.*

ii. Nectary-hood wide with a rather large lip; carpels hairy; taste of tubers rather indifferent, followed by a strong and persistent tingling sensation

† Inflorescence and carpels greyish pubescent; leaves divided almost to the base, ultimate divisions narrow; carpels usually 3 ... ... 6. *A. deinorrhizum.*

†† Inflorescence and carpels spreadingly yellowish tomentose; leaves rather less divided than in the preceding species, ultimate divisions broad; carpels 5 ... ... 7. *A. Balfourii.*

b. Cambium of tubers continuous, forming in cross-section a more or less sinuous ring

i. Secondary sieve-strands of mother-tubers not encased in sclerenchymatic sheaths; lip of nectary widened from the base upwards; leaf-segments not or slightly divaricate

† Leaves divided to in the inner, to ¾ or less in the outer incisions, ultimate divisions rather broad; carpels 5; follicles 10-18 mm. long

¶ Intermediate leaf-division rhomboid-cuneate, sparingly and coarsely inciso-crenate; nectary-hood much leaning forward, slightly widened at the top, scarcely gibbous; carpels glabrous or nearly so; follicles 14-18 mm. long ... ... 8. *A. Falconeri.*

¶¶ Intermediate leaf-division mostly ovate in outline, copiously inciso-crenate or dentate; nectary-hood slightly leaning forward, distinctly gibbous at the top; carpels villous; follicles about 10 mm. long ... ... 9. *A. spicatum.*

†† Leaves divided almost to the very base, ultimate divisions narrow; carpels mostly 3; follicles 18-25mm. long ... ... 10. *A. laciniatum.*

ii. Secondary sieve-strands of mother-tubers encased in sclerenchymatic sheaths, forming persistent fibres; lip of nectary narrow; leaf-segments conspicuously divaricate ... ... 11. *A. ferox.*

II. Stem very slender, twining

1. Flowers on recurved pedicels (up to 5 cm. long), nodding; helmet conic-ovate in profile ... 12. *A. Elwesii.*
2. Flowers on straight or almost straight pedicels (up to 7.5 cm. long); helmet depressed, semi-orbicular in profile ... ... 13. *A. lethale.*

1. **Aconitum luridum** Hook. fil. & Th. is found in the Himalaya from Eastern Nepal to Chumbi, between 12,000 and 14,000 ft. The root is reputed poisonous.

Bengal: Bish, Butsnabbish—; *Bhoti*: Tchendook—; *Bombay*: Butchnab—; *Darjeeling*: Soorja banshi—; *Hindi*: Mahoor—; *Nepal*: Atisingeeabish, Bikh, Bish, Bishnak—; *Sikkim*: Suya-banshi—; *Telugu*: Ativassa—.

2. **Aconitum chasmantum** Stapf inhabits the subalpine and Alpine zone of the Western Himalaya, from Chitral and Hazara to Kashmir, between 7,000 and 12,000 ft.

The root contains, according to Dunstan, very small proportions of aconitine (1897). Later the roots were examined by Dunstan and Andrews, and found to contain the crystalline alkaloid indaconitine (1905). But an alkaloid, obtained by Bauer and Radjhan, did not appear identical with indaconitine (1931).

Hazara: Mohri—; *Jhelum*: Mohri, Piun—; *Kashmir*: Ban-bal-nag—.

3. **Aconitum violaceum** Jacquem. occurs in the Alpine zone of the Himalaya from Gilgit to Kumaon, between 10,000 and 15,000 ft.

The roots are eaten by the hillmen of Kanawar as a pleasant tonic.

Kachung: Tilia kachang—; *Kashmir*: Jokser, Jokser me-hin-pat-val—; *Sutlej*: Tilia kachang—,

4. **Aconitum heterophyllum** Wall. is common in the subalpine and alpine zone of the Himalaya, from the Indus to Kumaon, from 6,000 to 15,000 ft.

Ayurvedists describe the root as a bitter tonic, hot, stomachic, and digestive. They recommend it as a remedy in fevers, diarrhoea, dyspepsia and cough, and also as an aphrodisiac and an astringent. They consider it useful in the treatment of bites and stings from poisonous animals.

Yunanists use the drug much in he same way as the Ayurvedists. Thus the root is a common Indian medicine employed as a mild and bitter tonic, aphrodisiac, antiperiodic and tonic.

The Central Indigenous Drugs Committee (1901) while admitting that the drug is a good bitter and tonic, declared it to be worthless as an antiperiodic. Koman (1919) reported having cured a case of acute dysentery and one of chronic enteritis. Caius and Mhaskar proved experimentally that it is not an antidote to snake venom (1931) and that it is useless in the treatment of scorpion sting (1932).

The alkaloid *atisine* has been obtained from the root.

Bashahr : Patis, Patris—; *Bhoti* : Ais—; *Bombay* : Atis, Atvika—; *Canarese* : Atibaje—; *Cutch* : Ativista—; *Gujerat* : Atavakhanikali, Atavishnikali, Ativakh, Ativish—; *Hindi* : Atis, Atvika—; *Jhelum* : Chitijari, Sukhi-hari—; *Kashmir* : Hongisafed, Mohandigujsafed, Mohundguji, Narmada, Nerr-mada—; *Lahul* : Bonga—; *Leh* : Ais—; *Marathi* : Atavish—; *Persian* : Batis, Vajjeturki—; *Punjab* : Bonga, Chitijari, Patis, Patris, Sukhihari—; *Sanskrit* : Amrita, Aruna, Ataicha, Atisaraghni, Ativisha, Bhangura, Bhringi, Ghunavallabha, Kashmira, Madri, Mahaushadham, Mahoshadha, Mridvi, Prativisha, Pravisha, Shishubhaishyajja, Shokapaha, Shringi, Shringika, Shuklanda, Shveta, Shvetakanda, Shvetavacha, Shyamkanda, Upvisha, Vira, Virupa, Visha, Visharupa, Vishva—; *Tamil* : Atividyam—; *Telugu* : Ativasa—.

5. **Aconitum palmatum** D. Don is found in the alpine Himalaya of Nepal, Sikkim, and the adjoining part of South Tibet, from 10,000 to 16,000 ft.

The non-poisonous root is tonic and antiperiodic; it is given for rheumatism and diarrhoea. Mixed with pepper it is used internally as a remedy for pains in the abdomen, diarrhoea and vomiting, and intestinal worms; externally it is used as an application for rheumatism.

The root contains the alkaloid *palmatisine.*

Bombay : Bikhma, Vakhma, Wakhma—; *Gujerati* : Vakhamo—; *Hindi* : Bikhma, Bishawa, Bishma, Bisma—; *Sikkim* : Gniong-rip-gmok, Setobikhoma—.

6. **Aconitum deinorrhizum** Stapf occurs in the alpine Himalaya of Bashahar.

The root contains the poisonous alkaloid *pseudaconitine.*

Bashahar : Doodhiya moura, Maura, Mohra—; *Gujerat* : Dudhio vachhanag—; *Hindi* : Mahoor, Mahore, Maur, Maura bikh, Mora, Moura bikh, Muhura—; *Kashmir* : Dudhia bish—; *Punjab* : Dudhia bish—; *Ravi* : Dudhia moura—; *Sutlej* : Kala mohra, Mahoor, Mahore, Maur, Maura bikh, Mohra, Mora, Moura bikh, Muhura—.

7. **Aconitum Balfourii** Stapf occurs in the subalpine and alpine Himalaya from British Garhwal to Nepal.

The tubers contain the poisonous alkaloid *pseudaconitine*.

Darma: Gobriya—; *Garhwal*: Banwa—; *Hindi*: Teliya, Teliya bachnag, Teliya bis—; *Lahore*: Bachnab—; *Nepal*: Gobari—; *Ralam*: Bhanva, Dhaulia, Dhumuriya, Fatkia, Gobaria, Gobriya, Jhirina, Kawriya, Phatkia, Phutkia, Ratwa, Tiliya—.

8. **Aconitum Falconeri** Stapf inhabits the alpine and subalpine zone of the Himalaya of Garhwal.

The root is evidently poisonous.

Hindi: Bikh, Bis, Mahoor, Mahore, Maur, Maura bikh, Meethatellia, Mora, Moura bikh, Muhura—; *Tihri Garhwal*: Mohra—.

9. **Aconitum spicatum** Stapf is found in the alpine zone of the Himalaya of Sikkim and Chumbi, between 10,000 and 12,000 ft.

This species is the principal source of the 'Bikh' or 'Bish' of the Calcutta market. The toxic principle is the alkaloid *bikhaconitine*.

Bengal: Dagra, Dakra, Katbish, Kathbish—; *Bombay*: Bachnab—; *Canarese*: Vasanabhi—; *Cutch*: Bachnaga—; *Deccani*: Lal bachnag—; *Gujerati*: Shingadiovachnag, Vachnag, Vachlanag—; *Hindi*: Bachhnag, Bachnag, Bachnak, Bechnak, Bikh, Bish, Bis, Kalabachhnag, Singya—; *Lepcha*: Ning—; *Malayalam*: Valsanabhi—; *Sanskrit*: Sringibish, Vatsanabha—; *Sikkim*: Bikh, Gniong, Gniongmot, Gniongning, Kalabikoma, Shoddukmot—; *Sinhalese*: Vachanabhi—; *Tamil*: Navi, Sennabi, Vachanavi—; *Telugu*: Nabhi, Vasanabhi—.

10. **Aconitum laciniatum** Stapf occurs in the subalpine and alpine Himalaya of Sikkim and adjoining Tibet, between 10,000 and 14,000 ft.

It forms, together with *A. spicatum*, the article known as 'Nepal Aconite'.

Sikkim: Kalobikhmo—.

11. **Aconitum ferox** Wall. is found in the alpine Himalaya of Nepal.

The drug is chiefly employed in India in the treatment of leprosy, fever, cholera, and rheumatism.

It is a very effective medicine in various diseases, acting as a narcotic sedative, regarded as heating and stimulant, useful in fever, cephalalgia, affections of the throat, dyspepsia, and rheumatism. It is much used as an external application, the root being formed into a paste and spread upon the skin in neuralgia, boils, etc. Internally it is chiefly used in the treatment of chronic intermittent fevers.

Ayurveda prescribes that the root be specially prepared before use. To this end the tough horny material is soaked in either urine or milk from the cow and exposed to the sun until it becomes so soft as to be easily pierced by a pin. The process requires three or more days and the urine or milk has to be renewed every day. Bose (K. C.) has shown that this treatment is attended with very important modifications of the physiological properties:—tincture of Aconite at first slows the heart-rate, lowers the blood pressure, and increases the peripheral circulation, later the heart-rate is accelerated and the blood pressure raised; after treatment of the root with cow's urine the tincture increases the rate and systole of the heart, the blood pressure, and the peripheral circulation, and the effects persist for a very long time. Mhaskar and Caius have confirmed those findings and demonstrated, moreover, that if the root is treated with cow's milk, instead of urine, the above changes are much more pronounced.

The root, either alone or in combination with other drugs, has been much recommended for the treatment of snake-bite and scorpion-sting; but Caius and Mhaskar have proved experimentally that the drug is not an antidote to snake venom and is useless in the treatment of scorpion-sting.

A preparation of the root is much used in all the hilly districts in India to poison arrows. The toxic principle is the alkaloid *pseudaconitine*.

Arabic: Bish—; *Assam*: Bish—; *Bengal*: Bish, Butsnabbish, Katbish—; *Bombay*: Butchnab—; *Canarese*: Vasanabhi, Vatsanabhi—; *Cutch*: Buchnaga—; *Gujerat*: Shingadiovachnag, Vachhanag, Vachnag—; *Hindi*: Bachhnag, Bachnak, Bis, Bish, Mahoor, Mithazahar, Singya, Singyabis, Teliyabis—; *Lepcha*: Lung-ji nying, Nyine, Nying—; *Malayalam*: Vatsanabhi—; *Marathi*: Bachnag, Vachnag—; *Nepal*: Atisingeeabish, Bikh, Bish, Bishnak—; *Persian*: Bishnag, Zher—; *Sanskrit*: Aheya, Amrita, Bhugara, Brahmaputra, Darada, Gara, Garada, Garala, Ghora, Halahala, Haridra, Jangala, Jangula, Jivanaghata, Kakola, Kalakuta, Kasakula, Kishala, Kshveda, Nila, Pradipana, Pranahara, Raktashringika, Rasa, Rasayana, Shanklakeya, Shringi, Sowrashtrika, Tikshna, Vatsanabha, Visha—; *Sinhalese*: Vachanabhi—; *Tamil*: Vashanavi—; *Telugu*: Ativasa, Naghi, Vasanabhi—.

12. **Aconitum Elwesii** Stapf is found in the alpine Himalaya of north-eastern Sikkim.

The root is reputed poisonous.

Lepcha: Tukschak gniong—.

13. **Acconitum lethale** Griff. occurs in the higher parts of the Mishmi mountains.

The root contains the non-poisonous alkaloid *palmatisine*. It is, however, believed to be the source of the celebrated 'Bhi' or 'Bis' poison of the Mishmis.

Mishmi: Bee, Bih, Bhi, Bis—.

ACTAEA.

This genus consists of 10 species distributed over the northern temperate regions.

A. alba Mill., *A. eburnea* Rydb., and *A. spicata* Linn. are used medicinally in North America by the Meskwaki, Pillager Ojibwe, and Forest Potawatomi Indians of the State of Wisconsin.

Actaea spicata Linn. occurs in the temperate Himalaya from Hazara to Bhutan. It is distributed to Northern Asia, Europe, and North America.

The root is an active emeto-purgative, acrid, parasiticide; it is held in repute as an expectorant and antispasmodic. It must be administered with caution.

Canadian doctors administer the root in snake-bite; and it is said to be attended with much success in the treatment of nervous diseases, rheumatic fever, chorea and lumbago. The berries were formerly used internally for asthma and scrofula, and externally for skin complaints.

The Pillager Ojibwe and the Forest Potawatomi Indians of Wisconsin make a tea from the root, to be drunk by women after childbirth; it is meant to clear up the system. White men use it for stomach troubles, and as a substitute for *Cimicifuga racemosa* Nuttall. It has been used in cases of ovarian neuralgia, uterine tenderness, sub-involution, and as a substitute for digitalis in the treatment of fatty or irritable heart. It affords some relief for a headache which is due to eye strain.

In some parts of Europe the powdered leaves, stems, and flowers are used as an insecticide. The toxic principle is referred to as 'oil of baneberry'.

Mhaskar and Caius have shown that the root is useless as an antidote to snake-bite.

Catalan: Herba de San Cristófol—; *English*: Baneberry, Bugbane, Grapewort, Herb Christopher, Toadroot—; *French*: Actée, Actée en épi, Christophoriane, Faux hellébore noir, Herbe aux poux, Herbe de saint Christophe—; *German*: Christophskraut, Christophswurz—; *Italian*: Barba di capra—; *North America*: Coral-and-pearl, European Baneberry, Grapewort, Herb Christopher, Poison-berry, Red Baneberry, Red-berry Snakeroot, Red Cohosh, Snake-berry, Toad-root—; *Ojibwe*: Wîckobidjibîk—; *Potawatomi*: Wasgobîdjibikeok—; *Spanish*: Cristobalina, Yerba de San Cristobal—.

ADONIS.

The genus numbers 10 species inhabiting the northern palaeotemperate regions, chiefly southern Europe and western Asia.

A. aestivalis Linn., *A. autumnalis* Linn., *A. microcarpa* DC., *A. vernalis* Linn. are used medicinally in Europe; *A. vernalis* Linn. is similarly used in North America.

The herb of *A. vernalis* Linn. is official in Austria, Holland, Italy, Russia, Spain, and Switzerland.

Adonis aestivalis Linn. extends from temperate Europe to Asia; it is found in the Western Himalaya from Peshawar to Hazara and Kumaon.

The whole plant is used as a cardiotonic and diuretic in Euope. The flowers are considered laxative, diuretic, and lithothriptic.

Baluchi: Buchki—; *Catalan*: Ull de perdiu—; *French*: Adonide d'été, Rougeotte—; *German*: Feuerroeschen—; *Languedoc*: Rubissa—; *Reggio*: Pe d'esen—; *Romagna*: Chiga sanev, Erba corta, Fior d'Adone, Gattapozzia—; *Russian*: Goritzvyet Krasnee—; *Sardinia*: Ogu de boi—; *Spanish*: Ojo de perdiz—; *Treviso*: Gioze de sanguse, Stiantamalanni—; *Waziri*: Chadangul, Lavang—.

ANEMONE.

This cosmopolitan genus numbers 100 species.

The following are used medicinally in Europe—*A. alpina* Linn., *A. coronaria* Linn., *A. hepatica* Linn., *A. narcissiflora* Linn., *A. nemorosa* Linn., *A. pratensis* Linn., *A. pulsatilla* Linn., *A. ranunculoides* Linn., *A. stellata* Lam., *A. sylvestris* Linn., *A. trifolia* Linn., *A. vernalis* Linn.—; in North America—*A. acutiloba* Laws., *A. cylindrica* A. Gray, *A. dichotoma* Linn., *A. parviflora* Michoe., *A. patens* Linn., *A. pratensis* Linn., *A. thalictroides* Linn., *A. virginiana* Linn.—; in Japan and China—*A. cernua* Thunb.—; in Indo-China—*A. cernua* Thunb., *A. dichotoma* Linn., *A. hepatica* Linn., *A. japonica* Sieb. and Zucc., *A. nikoensis* Max.—; in South Africa—*A. caffra* Harv., *A. transvaalensis* Prantl.—.

The leaves and flowers of *A. nemorosa* Linn. are official in Portugal, those of *A. pulsatilla* Linn. in France and Portugal.

A. multifida Poir. and *A. nemorosa* Linn. are reputed poisonous in America.

In Siberia the juice of *A. altaica* Fisch., *A. narcissiflora* Linn., *A. parviflora* Mich., *A. ranunculoides* Linn., *A. reflexa* Steph. is used to poison arrows.

Anemonin, or anemone camphor, has been obtained from *A. nemorosa, A. pratensis, A. pulsatilla,* and *A. transvaalensis.*

1. Achenes strigose, rarely glabrous. Radical leaves 3-partite ... ... *A. obtusiloba.*
2. Achenes nearly orbicular with an incurved beak. Leaves palmately 5-partite ... ... *A. narcissiflora.*

1. **Anemone obtusiloba** D. Don occurs in temperate and alpine Himalaya from Kashmir to Sikkim, between 8,000 and 15,000 ft.

In Hazara the pounded root, which is acrid, is mixed with milk and given internally for contusions. In Bessahir it is said to be used as a blister, but to be apt to produce sores and scars.

The seeds, if given internally, produce vomiting and purging. The oil extracted from them is used in rheumatism.

Jaunsar: Ageli—; *Kumaon*: Kakriya, Ratanjota, Rattanjog—; *Punjab*: Padar, Ratanjota, Rattanjog—.

2. **Anemone narcissiflora** Linn. is found in Kashmir. It is distributed to the Alps of Southern and Central Europe, Western Asia, Siberia, and North-Western America.

The plant is toxic and is used as a poison in most places where it is found growing.

AQUILEGIA.

The genus consists of 75 species occurring in the northern temperate regions.

A. alpina Linn., *A. Kitaibelii* Schott, *A. parviflora* Ledeb., *A. pyrenaica* DC., *A. vulgaris* Linn. are used medicinally in Europe; *A. canadensis* Linn., *A. formosa* Fisch., *A. vulgaris* Linn. are similarly used in North America.

Aquilegia vulgaris Linn. is found in the Western temperate and subalpine Himalaya; it is distributed over temperate Europe and Asia.

In Europe the plant and the seeds are credited with aperient, resolvent, diuretic, and diaphoretic properties. The leaves are generally used in lotions with good success for sore mouths and throats. A tincture is employed to strengthen the gums.

'Tragus saith that a dram of the seed taken in wine with a little saffron openeth obstructions of the liver and is good for the yellow jaundice, if the person after taking thereof be laid to sweat well in bed. The seed also taken in wine causeth a speedy delivery of women in childbirth; if one draught suffice not let her drink a second, and it will be found effectual. The Spaniards used to eat a piece of the root thereof in a morning fasting, many days together, to help them when troubled with stone in the veins or kidneys.'

The plant contains a cyanogenetic glucoside.

Catalan: Ausellets, Corns, Perfet amor—; *Dutch*: Akelei—; *English*: Blue Starry, Boots-and-shoes, Capon's-feather, Capon's-tail, Cock's-foot, Colombine, Colourbine, Columbine, Cullavine, Culverkeys, Culverwort, Curranbine, Dove's-foot, Granny's Night-cap, Hawk's-feet, Hen and Chickens, Lady's shoes, Lady's slippers, Snapdragon, Sowdwort, Two faces under a hat—; *French*: Ancholie, Ancholie commune, Ancholie des jardins, Ancholie sauvage, Ancholie vulgaire, Ancolie, Bonne-femme, Clochette, Colombine, Cornette, Eglantine, Fleur-églantine, Galantine, Gants de Notre-Dame, Gélantine, Manteau royal—; *German*: Acklei, Adlerblue, Adlersblume, Aglei, Akelei, Falsche Glockenblume, Glockenblume, Harlekinsblume, Jowisblume, Jupiterblume, Unsererliebenfrauenhandschuh—; *Italian*: Amor mascosto, Aquilegia, Aquileia, Aquilina—; *Roumanian*: Caidarusa, Cinci coade, Clopotei cornuti—; *Russian*: Vadasbor—; *Spanish*: Aquileña, Aquileña, Manto real, Pajarilla, Pajaritas—; *United States*: Boots-and-shoes, Cock's-foot, Culverwort, Dove's-foot, European Columbine, Garden Columbine, Granny's-nightcap, Hawk-feet, Lady's-shoes—.

CALTHA.

The genus numbers 20 species inhabiting the temperate regions of the world.

Caltha palustris Linn. is found in western temperate Himalaya from Kashmir to Nepal, between 8,000 and 10,000 ft. It occurs in temperate Europe and North America.

Every part of the plant is strongly irritant, and cases are on record of serious effects produced by rashly experimenting with it. The juice is efficacious in curing warts.

Internally, the boiled young sprouts were used by the Iroquois in rheumatism and neuritis.

In the Pyrenees and in Germany the young buds are pickled like capers.

A tincture made from the whole plant when in flower may be given in cases of anaemia, in small, well-diluted doses.

Catalan: Flor del mal d'ulls—; *English*: Bassinet, Big Watercup, Blob, Boots, Bublican, Bull-flower, Bulls' Eyes, Butter-blob, Carlock-cups, Chirms, Christ's Eyes, Claut, Colt's Foot, Crow Cranes, Crazy, Dandelion, Drunkard, Fire o'Gold, Golden Cup, Goldins, Golds, Gollin, Great Butter-flower, Ground Ivy, Halcups, Horse-blobs, John Georges, Johnny Cranes, Kingcob, King Cup, Leopard's Foot, Mare-blebs, Mare-blob, Marsh Horsegowl, Marsh Mallow, Marsh Marigold, May Blobs, Mayflower, Meadow Bouts, Meadow Bright, Meadow Gowan, Moll-blob, Open Gowan, Palsywort, Publicans and Sinners, Soldiers' Buttons, Water-blobs, Water-bouts, Water Buttercup, Water Caltrops, Water Dragon, Water Goggles, Water Gowan, Wild Bachelor's Buttons, Yellow Gowan—; *French*: Populage, Souci d'eau, Souci des marais—; *German*: Butterblume, Dotterblume, Kuhblume, Sumpfdotterblume—; *Italian*: Farferugine—; *Menomini*: Wäsasipu 'Kwa—; *North America*: American Cowslip, Cowslip, Cow's Lip, Marsh Marigold—; *Ojibwe*: O'îgîte'bûg—; *Punjab*: Baringu, Mamiri—; *Spanish*: Calta, Centella palustre, Yerba centella—.

CIMICIFUGA.

This genus consists of 12 species, which inhabit northern temperate regions.

C. foetida Linn. is used medicinally in Europe, China, and Indo-China; *C. racemosa* (L.) Nuttall in North America, where the dried rhizome and roots are official.

Cimicifuga foetida Linn. inhabits temperate Himalaya from Kashmir to Bhutan, between 7,000 and 12,000 ft. It is found in Siberia and Eastern Europe.

The plant is a nerve depressant.

In Europe the root is considered a mild emeto-purgative. In China and Indo-China it is used as an antiperiodic and sudorific, and prescribed in rheumatic affections, dropsy, the early stage of phthisis, and chronic bronchial diseases.

In Siberia the root is used to drive away bugs and fleas.

Annam: Thang ma—; *Chinese*: Sheng Ma—; *English*: Bugbane—; *French*: Actée fétide, Chasse-punaise, Cimicaire, Herbe aux punaises—; *German*: Wanzenkraut—; *Punjab*: Jiunti—; *Spanish*: Yerba de las chinches—.

CLEMATIS.

A cosmopolitan genus numbering 220 species, rare in the tropics.

This genus is acrid and poisonous; the leaves and fresh stems, if bruised and applied to the skin, cause vesication; in some species the seeds have purging properties.

The following species are used medicinally in Europe—*C. alpina* Mill., *C. flammula* Linn., *C. integrifolia* Linn., *C. recta* Linn., *C. vitalba* Linn., *C. viticella* Linn.—; in Indo-China—*C. apiifolia* DC., *C. chinensis* Retz., *C. dioica* Linn., *C. florida* Thunb., *C. paniculata* Thunb., *C. patens* Morr. and Dec., *C. smilacifolia* Wall., *C. virginiana* Linn., *C. vitalba* Linn.—; in China—*C. apiifolia* DC., *C. chinensis* Retz., *C. paniculata* Thunb., *C. recta* Linn.—; in North America—*C. crispa* Linn., *C. ligusticifolia* Nutt., *C. viorna* Linn., *C. virginiana* Linn.—; in Jamaica—*C. dioica* Linn.—; in Guinea and Nigeria—*C. grandiflora* DC., *C. Thunbergii* Steud.—; in the islands of Mauritius and La Reunion—*C. mauritiana* Lam.—; in Madagascar—*C. Bojeri* Hook., *C. mauritiana* Lam., *C. saxicola* Bojer and Hills.—; in Southern Africa—*C. brachiata* Thunb., *C. stanleyi* Hook., *C. stewartiae* Burtt-Davy—.

A. Achenes with long feathery styles. Flowers in axillary fascicles; pedicels 1-flowered	1. *C. napaulensis.*
B. Achenes with long feathery tails. Flowers in axillary panicles	
I. Filaments glabrous, connective of anthers not produced	
a. Glabrous	3. *C. smilacifolia.*
b. Silky	2. *C. triloba.*
c. Young parts pubescent	4. *C. gouriana.*
II. Filaments hairy, connective of another not produced	5. *C. graveolens.*

1. **Clematis napaulensis** DC. is found in teemperate Himalaya from Garhwal to Bhutan. In Kumaon throughout, between 4,500 and 7,000 ft., in shady moist ravines.

In Kanawar the leaves are said to act deleteriously on the skin.

Kumaon: Ghantiali, Jai, Kanguli—; *Punjab*: Birri, Pawanne, Wandak—.

2. **Clematis triloba** Heyne inhabits the Bombay Presidency: Konkan and Deccan, Western Ghats.

It is applied externally to boils and itch, and to parasitic worms.

It is prescribed for the treatment of snake-bite; but Mhaskar and Caius have found every part of the plant equally useless in the antidotal treatment of snake-bite.

Bombay: Moravela, Moriel, Morvel, Ranjae, Ranjai—; *Canarese*: Morhari—; *Gujerat*: Morvel—; *Hindi*: Churahar, Dhantiali, Murhari—; *Marathi*: Moravela, Morbel, Ranjai—; *Matheran*: Morvel, Ranjat—; *Porebunder*: Trekhdovelo—; *Sanskrit*: Murva, Devashreni, Devi, Dhanurmala, Dhanurguna, Dridhasutrika, Gokarni, Laghuparnika, Madhulika, Madhurasa, Madhushreni, Madhusrava, Morata, Piluparni, Prithakaparni, Snigdhaparni, Snuva, Tejani—; *Sind*: Maruva—.

3. **Clematis smilacifolia** Wall. occurs in Kumaon, the Himalaya from Sikkim eastwards up to 5,000 ft., Assam, Ganjam, Konkan, Kanara and Deccan of the Bombay Presidency. It extends to Indo-China, Java, Borneo, and the Philippine Islands.

In Indo-China a decoction of the roots is used for aching of the muscles.

Canarese: Hottuhambu—; *Indo-China*: Day ong lao, Khoua kau san, Linh tien—; *Lepcha*: Krang rik—; *Malayalam*: Vatiyampu—; *Sinhalese*: Narawel—; *Telugu*: Gurraputige—.

4. **Clematis gouriana** Roxb. is found in the Punjab hills, the Western Himalaya up to 5,000 ft., the hilly districts throughout India between 1,000 and 3,000 ft., and Ceylon. It is distributed to Java and the Philippine Islands.

The leaves of the fresh stems, if bruised and applied to the skin, cause vesication.

Bombay: Moriel, Morvel, Ranjai—; *Canarese*: Telejadari—; *Dehra Dun*: Belkangu, Belkum, Belkun—; *English*: Indian Traveller's Joy—; *North-Western Provinces*: Belkangau, Belkun—; *Saora*: Pannedang, Pedutivva—; *Uran*: Golarang—; *Uriya*: Boromojhanti, Idiya—; *Visayan*: Calupad, Tolangsangbanug—.

5. **Clematis graveolens** Lindl. inhabits the Western temperate Himalaya to Kumaon, between 6,000 and 11,000 ft., and extends to Baluchistan, where it is considered poisonous.

Baluchi: Hushokawal—.

COPTIS.

This genus consists of 10 species which are found in the northern temperate and arctic regions of the world.

C. anemonaefolia Sieb. and Zucc. is used medicinally in Malaya, Indo-China, Japan, and North America; *C. teeta* Wall. in India, Malaya and China; *C. trifolia* Salisb. in North America.

Berberine has been isolated from *C. teeta* and *C. trifolia*.

The dried rhizome of the species growing in Japan is official in the Japanese pharmacopoeia.

Coptis teeta Wall. grows in the temperate parts of the Mishmi mountains, east of Assam.

The root is an all-round tonic and stomachic medicine. It has been found to produce excellent effects in debility, convalescence after fevers and other debilitating diseases, atonic dyspepsia, and in mild forms of intermittent fevers.

It is used in Sind, Assam, and other parts of India for restoring the appetite, being given in infusion; also as an appliation on sores and for inflammation of the eyes.

It contains berberine and coptine.

Assam : Mishmeeteeta, Tita— ; *Bombay* : Mamiran, Mishmitita— ; *Cantonese* : Choon lin— ; *Chinese* : Huang Lien— ; *English* : Coptis, Gold Thread— ; *French* : Coptide— *Hindi* : Mamira, Mamiran, Mishmitita— ; *Malaya* : Choon lin— ; *Sind* : Mahmira— ; *Sinhalese* : Pitakarosana—.

DELPHINIUM.

The genus numbers 150 species, natives of temperate regions in the northern hemisphere.

The flowers are acrid, bitter, astringent; the seeds are emetic, cathartic, anthelmintic, and insecticidal.

The following species are used medicinally in Europe—*D. ajacis* Linn., *D. consolida* Linn., *D. elatum* Linn., *D. grandiflorum* Linn., *D. hybridum* Willd., *D. laxiflorum* DC., *D. montanum* DC., *D. orientale* Gay., *D. palmatifidum* DC., *D. peregrinum* Linn., *D. pubescens* DC., *D. staphisagria* Linn., *D. triste* Fisch.—; in Indo-China—*D. ajacis* Linn.—; in North America—*D. ajacis* Linn., *D. consolida* Linn., *D. staphisagria* Linn.—.

Deltaline has been isolated from the whole plant of *D. occidentale* S. Wats., and delcosine from *D. consolida* Linn.

Ajacine, and ajaconine have been isolated from the seeds of *D. ajacis;* delphinine, delphisine, delphinoidine, and staphisagroine have been obtained from the seeds of *D. staphisagria.*

D. consolida Linn. in flower is official in Portugal; the seeds of *D. staphisagria* Linn. are official in France, Holland, and Portugal.

I. Spur subulate	
1. Radical leaves 5-15 cm. diam., orbicular, divided to the base or nearly so, 5-9-parted. Follicles 3.	1. *D. denudatum.*
2. Radical leaves 3-4 cm. diam., suborbicular, 5-7-lobed. Follicles 5	2. *D. caeruleum.*
3. Radical leaves 10-15 cm. diam., orbicular or reniform, 5-7-lobed or -parted. Follicles 3 ...	3. *D. elatum.*
II. Spur inflated, conical	4. *D. Brunonianum.*

1. **Delphinium denudatum** Wall. occurs in the Western temperate Himalaya from Kashmir to Kumaon, between 8,000 and 12,000 ft.,

Ayurveda doctors consider the bitter root as cooling, vulnerary, and alexiteric. They recommend its use for diseases of the blood, and for the treatment of snake-bite and scorpion-sting.

Yunanists describe the root as a stimulant in conditions of debility, a brain tonic useful in insanity, an analgesic good in tooth ache and in painful piles, an antidote to snake and scorpion venoms. The drug promotes appetite, but it is strongly binding and a purgative should be administered with it.

In Bashahr the root is used for tooth ache, and also as an adulterant for aconite.

Mhaskar and Caius have shown that the root is not an antidote to either snake or scorpion venom.

Arabic: Judwar, Mahferfin—; *Bhutia*: Nirbisi—; *Canarese*: Nirvishi—; *Gujarat*: Nirvishi—; *Hindi*: Judwar, Nirbishi, Nirvisi—; *Jaunsar*: Main—; *Marathi*: Nirvishi—; *Nepal*: Nilobikh—; *Persian*: Zadwar—; *Punjab*: Judwar—; *Sanskrit*: Apavisha, Avisha, Nirvisha, Vishabhava, Vishaha, Vishahantri, Vishavairini, Vivisha—; *Simla*: Manila—; *Sind*: Judwar—; *Urdu*: Jadwar—.

2. **Delphinium caeruleum** Jacq. is found in the alpine Himalaya from Kumaon to Sikkim, up to 17,000 ft. in the Eastern Himalaya.

The root is applied to kill the maggots in the wounds of goats.

Punjab: Dakhangu, Dhakangu—.

3. **Delphinium elatum** Linn. spreads over the western temperate Himalaya from Kashmir to Kumaon, between 10,000 and 12,000 ft.

The whole plant, but more especially the seed, is emetic, aperient, diuretic, and anthelmintic.

This plant is found growing in Europe where the seeds are used as insecticides, and much employed in the treatment of itch and other skin eruptions. The flowers are astringent and used in troubles of the eye.

The toxic principles are delphinine, delphisine, and delphinoidine.

4. **Delphinium Brunonianum** Royle grows in the alpine region of Western Tibet at an altitude of 14,000 ft.

The juice of the leaves of this plant is used in Kurram to destroy ticks in animals, chiefly when they affect sheep. In Leh it is considered so poisonous that the dew from the leaves falling on grass is said to poison cattle and horses.

Garhwal: Kasturi—; *Kumaon*: Nepari—; *Ladakh*: Ladara—; *Pangi*: Mundwal—; *Ravi*: Sapfalu—; *Sutlej*: Laskar, Liokpa, Panni, Ruskar, Spet, Supalu—.

NIGELLA.

The genus includes 16 species, natives of the Mediterranean region and Central Europe, one of them cultivated and run wild in India.

The following are used medicinally in Europe—*N. arvensis* Linn., *N. damascena* Linn., *N. hispanica* Linn., *N. sativa* Linn.—; in Syria—*N. orientalis* Linn.—; in Algeria and the Hadramaut—*N. arvensis* Linn.—; in Malaya and North America—*N. sativa* Linn.—.

Nigella sativa Linn. is found in the Punjab and Bihar, sometimes cultivated and an occasional weed of cultivation. It extends to the Mediterranean region.

The seeds when bruised are strongly scented, and they are used in Europe as emmenagogues, diuretics, and galactagogues. They are carminative and are an excellent adjunct to purgative draughts. Put among woollens, furs, etc., they prevent the attack of insects.

In the Presidencies of Bengal and Bombay the seeds are given to nursing women to promote the secretion of milk. In the Punjab they are reckoned stimulant, and are administered by hakeems in milk for rheumatism and cough. It is said they were at one time used in place of pepper.

The oil expressed from the seeds is employed for the same purposes as the seed.

In eruptions of the skin the seeds reduced to powder and mixed with sesamum oil are much used in India as an external application.

Koman found the seeds useful in mild cases of puerperal fever.

The seeds have been recommended for the treatment of snakebite and scorpion-sting; but Mhaskar and Caius have demonstrated that they are not an antidote to snake venom, and that they are useless in the treatment of scorpion sting.

Afghanistan: Shewadaru, Siyahdaru—; *Arabic*: Habbat-us-suda, Hab-es-souda, Kamun-e-avad, Shoonez, Shuniz—; *Bengal*: Kalajeera, Kalijira, Kalzira, Mugrela—; *Bombay*: Kalenjira, Kalonji—; *Burma*: Samonne—; *Canarese*: Karejirage, Karijirigi, Karimsiragam—; *Deccan*: Kulanjan—; *Egypt*: Habb-suda, Hubsindee, Kamnun iswid, Niyeh—; *English*: Black Cummin, Fennel Flower, Nutmeg Flower, Roman Coriander, Small Fennel—; *French*: Cumin noir, Faux cumin, Nielle de Crète, Nielle romaine, Nigelle cultivée, Nigelle romaine, Quatre épices, Toute épice—; *German*: Schwarzkuemmel, Gemeiner Schwarzkuemmel, Roemischer Schwarzkuemmel—; *Gujerati*: Kalonjijirum—; *Hebrew*: Qesah—; *Hindi*: Kalajira, Kalonji, Mugrela—; *Iraq*: Habbat-soda—; *Italian*: Cinnamonea, Cuminella, Erba spezie—; *Kashmir*: Tukmigandna—; *Malaya*: Ku sheng—; *Malayalam*: Karunchirakam, Karunshiragam—; *Mauritius*: Cumin noir, Nigelle—; *North America*: Black Caraway, Black Cumin, Fitch, Roman Coriander—; *Persian*: Shuniz, Siahudanah, Siyahbiranj—; *Punjabi*: Kalvanji—; *Russian*: Tchernushka—; *Sanskrit*: Bashpika, Kalajaji, Karava, Karavi, Krishnajiraka, Kunchi, Kunchika, Kunjika, Musavi, Prathvika, Prithivi, Frithu, Prithuka, Prithivi, Sthuljiraka, Sushavi, Upakunchiraka—; *Sinhalese*: Kaluduru—; *Tamil*: Karunjiragam—; *Telugu*: Nellajeelakara, Nullajilakara—.

PAEONIA.

This genus numbers 15 species distributed over Europe, Asia, and the western part of North Africa.

The following are used medicinally in Europe—*P. corallina* Retz., *P. Moutan* Sims, *P. officinalis* Linn., *P. peregrina* Mill., *P. tenuifolia* Linn.—; in Japan, China, and Indo-China—*P. albiflora* Pall., *P. Moutan* Sims—; in California—*P. Brownii* Dougl., *P. officinalis* Linn.—.

Paeonia emodi Wall. is found in the Western Himalaya from Kashmir to Kumaon.

The tubers of this plant are highly esteemed by hakeems as a medicine for uterine diseases, colic, bilious obstructions, dropsy, epilepsy, convulsions and hysteria. *Ud-salap* is generally given to children as a blood-purifier.

In Booner, the root in combination with other drugs is a favourite remedy for bruises, sprains, etc.

An infusion of the dried flowers is highly valued as a remedy for diarrhoea.

The seeds are emetic and cathartic.

Bhutia: Bhumamadiya, Yetghas—; *English*: Himalayan Paeony, Paeony Rose—; *Hindi*; Udsalap—; *Kashmir*: Mid—; *North-Western Provinces*: Chandra—: *Punjab*: Mamekh—; *Urdu*: Udasaliba—.

RANUNCULUS.

The genus includes 300 species distributed all over the world, but most numerous in temperate or cool regions.

The following species are used medicinally in Europe— *R. acris* Linn., *R. arvensis* Linn., *R. asiaticus* Linn., *R. bulbosus* Linn., *R. falcatus* Linn., *R. Ficaria* Linn., *R. Flammula* Linn., *R. glacialis* Linn., *R. gramineus* Linn., *R. hederaceus* Linn., *R. Lingua* Linn., *R. monspeliacus* Linn., *R. muricatus* Linn., *R. pedatus* W. & K., *R. parviflorus* Linn., *R. repens* Linn., *R. sceleratus* Linn., *R. Thora* Linn., *R. trichophyllus* Chaix, *R. trilobus* Desf.—; in China—*R. acris* Linn., *R. sceleratus* Linn.—; in Indo-China—*R. Langsdorfii* DC., *R. pensylvanicus* Linn. f., *R. sceleratus* Linn., *R. ternatus* Thunb.—; in North America—*R. abortivus* Linn., *R. bulbosus* Linn., *R. Flammula* Linn., *R. multifidus* Pursh., *R. sceleratus* Linn.—; in Madagascar—*R. pinnatus* Poir.—; in South Africa—*R. capensis* Thunb., *R. pinnatus* Poir., *R. pubescens* Thunb.—.

A. Water plant. Flowers white	1. *R. trichophyllus.*
B. Land plants. Flowers yellow	
I. Achenes smooth or granular, not muricate or tubercled, shortly beaked	
1. All leaves undivided, lanceolate, entire or remotely toothed	2. *R. Lingua.*
2. Leaves 3-partite. Achenes many in an oblong head, not margined	3. *R. sceleratus.*
3. Leaves ternatisect. Achenes smooth, glabrous, margined	4. *R. pensylvanicus.*
II. Achenes tubercled or muricate	
1. Sepals appressed to and half the length of the petals	5. *R. arvensis.*
2. Sepals reflexed, rather shorter than the petals ...	6. *R. muricatus.*
III. Achenes gibbous at the side with a long terminal beak.	7. *R. falcatus.*

1. **Ranunculus trichophyllus** Chaix is found in the plains of the Punjab, in the Western Himalaya from the Indus to Kumaon ascending to considerable elevations, in Waziristan, Baluchistan and Afghanistan whence it extends to North Africa and Europe and spreads over the temperate parts of both hemispheres.

The amount of toxic principle is so small as to be negligible and, in Europe, the plant is given in intermittent fevers, rheumatism, and asthma.

English: Water Crowfoot, Water Fennel—.

2. **Ranunculus Lingua** Linn. occurs in Kashmir; it is found throughout the temperate zone of the northern hemisphere.

In Europe the leaves are applied as a blister to the wrists in rheumatism.

English: Great Spearwort, Sparrow Weed, Sparrow Crowfoot—; *French*: Grande douve, Renoncule lancéolée—; *German*: Grosser Hahnenfuss—.

3. **Ranunculus sceleratus** Linn. is found in Mount Abu, Sind, Waziristan, Northern India, the warm valleys of Himalaya, and Bengal; it extends to Siam and the temperate zone of the northern hemisphere.

The plant is an emmenagogue and a galactagogue; it is much used in the treatment of skin diseases.

The fresh plant is poisonous, and produces violent effect if taken internally. The bruised leaves form an application to raise blisters, and may also be used to keep open sores caused by vesication, or by other means.

The leaves are still used occasionally in Europe as a vesicant. When made into a tincture with spirit of wine, and given in small diluted doses, the plant proves curative of stitch in the side, and of neuralgic pains between the ribs, likewise of pleurisy without feverishness.

In Indo-China the seeds are given as a stomachic, to destroy foul breath, to reduce abscesses, and in kidney troubles.

The plant contains an acrid volatile oil, an inert resin, and a narcotic principle called *anemonin*.

Arabic: Kafessaba—; *Catalan*: Gata rabiosa—; *Chinese*: Shih Lung Juei—; *Danish*: Puggepebe—; *Dutch*: Water haanewoet—; *Egypt*: Zaghalanta, Zaghlul—; *English*: Celery-leaved Buttercup, Celery-leaved Crowfoot, Marsh Crowfoot, Water Celery—; *French*: Grenouillette aquatique, Grenouillette d' ean, Herbe sardonique, Mort aux vaches, Renoncule des marais, Renoncule scélérate—; *German*: Blasenziehender Hahnenfuss, Boese Ranunkel, Boesewicht, Froscheppich, Giftranunkel—; *Indo-China*: Thach long noi—; *Italian*: Appio riso, Erba sardonica, Pie corvino, Ranocchiella aquatica, Ranunculo di palude—; *Kumaon*: Shim—; *North America*: Biting Crowfoot, Blisterwort, Cursed Crowfoot, Marsh Crowfoot, Water Celery—; *Persian*: Kabikaj—; *Portuguese*: Ranunculo mataboi—; *Spanish*: Ranunculo malvado—; *Tirhut*: Polica—.

4. **Ranunculus pensylvanicus** Lin. fil. is found in the Upper Gangetic Plain, the Nepal Terai, the Khasia hills up to 6,000 ft.; it extends to North China, Amur-land, and North America.

The plant is used to raise blisters.

Indo-China: Tieu hoi hoi toan—.

5. **Ranunculus arvensis** Linn. occurs in the Western Himalaya from Kashmir to Kumaon, in Mount Abu, in Afghanistan, extending to temperate Asia, Siberia, Europe, and North Africa.

In Europe the plant is used in intermittent fevers, gout, and asthma.

As a fodder it frequently produces symptoms of irritant poisoning.

The leaves are said to contain hydrocyanic acid.

Baluchi: Zardphul—; *Boya*: Kanjarvaliai—; *Egypt*: Zaghalantah—; *English*: Corn Buttercup, Corn Crowfoot, Crow's-claws, Devil-on-both-sides, Devil's-claws, Devil's Coach-wheel, Devil's Currycomb, Dill-cup, English Staves-acre, Field Crowfoot, Goldweed, Gye, Hard-iron, Hedge-hog, Hellweed, Horse Gold, Hungerweed, Jack-o'-both-sides, Joy, Peagle, Prickle-backs, Scratchbur, Starveacre, Yellowcup, Urchin Crowfoot, Yellow Crees—; *French*: Bassinet des champs, Picot, Piguereaux—; *Malta*: Devil's Claws, Hedgehog—; *Miram Shah*: Zirgulac—; *Punjab*: Chambul—; *Spanish*: Coronilla de la Virgen, Gata rabiosa, Yerba del amor—; *Waziri*: Peri makhlak, Sarsundan—.

6. **Ranunculus muricatus** Linn. occurs in the Punjab and Punjab Himalaya, Kashmir, Western Asia, Europe, and North America.

In Europe the plant is used in intermittent fevers, gout, and asthma.

Egypt: Zaghlil—; *Spanish*: Abrojos a cuatro—.

7. **Ranunculus falcatus** Linn. occurs in Kashmir, Punjab, Baluchistan, Western Asia, and South-eastern Europe.

The plant when pounded and applied to the skin produces blisters.

Baluchistan: Wahwashu—; *Pushtu*: Karamghundai—.

THALICTRUM.

The genus consists of 80 species which inhabit the northern hemisphere.

The following are used medicinally in Europe—*T. angustifolium* Linn., *T. aquilegifolium* Linn., *T. flavum* Linn.—; in Indo-China—*T. aquilegifolium* Linn., *T. flavum* Linn., *T. foliolosum* DC.—; in North America—*T. polycarpum* S. Wats.—; in South Africa—*T. minus* Linn.—.

Achenes short, oblong, ribbed, subsessile. Leaves ternately or pinnately decompound.
1. Stem 4-8 ft. glabrous. Achenes usually 2-5, small, oblong ... ... *T. foliolosum*.
2. Stem 2-4 ft. erect. Achenes 5-8, oblong ... *T. minus*.

1. **Thalictrum foliolosum** DC. is found throughout the Himalaya between 5,000 and 8,000 ft., the Khasia hills between 4,000 and 6,000 ft., Burma, and Siam.

The root combines tonic and aperient properties, and has been found useful in convalescence after acute diseases, in mild forms of intermittent fevers, and in atonic dyspepsia.

The root is largely used as an *anjan*, or application for ophthalmia in Afghanistan and throughout India.

In the Punjab, the root is used as a purgative and diuretic.

Arabic: Mamiranchini—; *Bengal*: Gurbiani—; *Bombay*: Mamiran—; *Hindi*: Mamira, Pilijari, Pinjari, Shuprak—; *Kashmir*: Chaitra—; *Kumaon*: Barmat, Penglajari, Pilajari—; *Persian*: Mamiranchini—; *Punjab*: Chireta, Chitramul, Gurbiani, Keraita, Mamira, Pashmaran, Phalijari—.

2. **Thalictrum minus** Linn. is found in the inner valleys of the Temperate Himalaya, and in West Tibet between 9,000 and 12,000 ft.; it is distributed to Northern Asia, Europe, Abyssinia and Southern Africa.

An infusion of the leaf or a decoction of the root is used by the Sutos for fever.

Sosuto: Lefokotsane, Tloro-ya-ngwale—.

THE NAMES OF TWO INDIAN VIPERS.

By

Malcolm Smith, M.R.C.S.

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Trimeresurus popeiorum, nom. nov.

The discovery by Mr. and Mrs. Pope that the snake generally known as *Trimeresurus gramineus,* the Common Green Pit Viper (*sensu* Boulenger), included four species, was due largely to their investigation of the hemipenis. This work has not yet met with general acceptance, but no one who has critically examined it can doubt the correctness of their observations.

The four species distinguished by them were *gramineus, stejnegeri, albolabris* and *occidentalis.* Two distinct types of hemipenis were defined, namely, a short spinous type found in *stejnegeri* and *occidentalis,* and a long, calyculate, spineless one, found in *gramineus* and *albolabris.* The character of the hemipenis is the only one by which *gramineus* (*sensu* Pope) can be distinguished from *stejnegeri;* in all external morphological characters the snakes resemble one another and none has been found yet by which to distinguish the females.

T. gramineus was restricted by them to the Indo-Chinese region, its most westerly limit being Darjeeling and the Jalpaiguri district in the Eastern Himalayas, a region which is mainly Indo-Chinese in its fauna. For the species which inhabits the Peninsula of India no name was available, and they called it *occidentalis.* This choice was unfortunate,, for the type locality of *T. gramineus* Shaw, based on Russell's 'Bodroo Pam', described and figured by him in his *Indian Serpents,* p. 13, pl. ix, is Vizagapatam, and is well outside the range of *gramineus* as defined by Mr. and Mrs. Pope. Russell's description of the colour is as follows:—'The head and trunk and tail of a fresh green; the last row of squamae on the belly yellow. The scuta of a pale straw colour and some of them have a small, green spot on each side.' This peculiar coloration of the ventrals, that is, the green of the dorsal scales, splashed over as it were, on to the ventrals, is well shewn in the coloured figure and it is found only, though not in every specimen, in the snake which inhabits the Peninsula of India.

I feel convinced therefore that the name *gramineus* Shaw should be applied to the Indian snake and *T. occidentalis* will become a synonym of it. For the *gramineus* of Mr. and Mrs. Pope no name is available and I have pleasure in connecting theirs with it.

Ancistrodon nepa Laurenti.

In 1908 Col. Wall described a new Viper from Ceylon under the name of *Ancistrodon millardi* (*J.B.N.H.S.,* xviii, p. 792). It had been confused with *A. hypnale* Merrem but differed in having more ventrals and subcaudals and in slight differences in the proportions of the head shields. Later he discovered that the name *hypnale* should have been applied to the snake with the high ventral and caudal count and he therefore reversed the names (*idem,* xxx, 1925, p. 248). Such action however is not possible under the Rules of Zoological Nomenclature which state that a name once published cannot be rejected, even by its author, because of inappropriateness (Art. 32).

A name however is already available for this snake. An examination of the hemipenes of the two species shews that they differ from one another in exactly the same way as do *Trimeresurus stejnegeri* and *T. popeiorum,* the hemipenis of *hypnale* being calyculate and without spines, that of the other strongly spinous. This permits Laurenti's name *nepa* (*Coluber nepa, Syst. Rept.,* 1768, p. 97) based on a figure in Seba (I, pl. 19, fig. 7), and relegated by Boulenger with a query to the synonymy of *hypnale,* to be used. Seba's figure shews an undoubted Viper, like *hypnale,* with an everted and spinous hemipenis, the very character in fact which is needed for diagnosis. The fact that the snake was said to have come from Madagascar need not concern us, for many of Seba's localities are known to be incorrect. Moreover no member of the Viperidae is known to inhabit that Island.

GAME BIRDS IN THE ANAIMALAI HILLS AND THE SOUTH COIMBATORE DISTRICT.

By

J. Williams.

(*Witht one plate*).

On reading some of Mr. Stuart Baker's books on Game Birds recently I found remarkably few references to the occurrence of Game Birds in this area. I have done a lot of wandering with a shot gun during the past thirteen years, and the occurrence of birds which I have been able to identify may be of some use to the Society's records. The area over which I have shot may be divided into two sections.

(1) The developed area of tea known as the Anaimalai Planting District with Valparai as its centre, together with the Grass Hill and Sholah country above it.

The planted area was originally dense evergreen rain forest, some of which still exists between the estates and the Grass Hills. Planting of tea, coffee, cardamoms, and cinchona was started about 1898, but the bulk of the estates were opened much later between the years 1917 and 1930. The planted area is now about 30,000 acres, and is all on a plateau of undulating country between 3,000 and 4,500 ft. high. There are belts of original forest, coffee under planted shade, and blocks of cardamoms under original forest, throughout the district, but the bulk of the area is open tea land.

There are no paddy fields in the area at all, but throughout the tea there are small patches of swamps and perennial streams some of which are covered with heavy scrub, and some of which are open. The rainfall varies between 120 and 300 inches a year for different parts of the district. The bulk of this falls in the S.W. monsoon between June and August, but more or less heavy showers occur in most months of the year except January, February and March which are very dry.

The Grass Hill country runs up to 8,000 ft. and is short grass dotted with thick patches of stunted forest very similar to the Nilgiri plateau. It connects us with the High Range district in Travancore.

Game Birds are nowhere very numerous, but the following have been shot or seen in the area.

The Fantail Snipe. [*Capella gallinago* (Linn.)].

This bird frequents the swamps and streams throughout the planted area. Of recent years they have been much more numerous; presumably they did not frequent the country at all when it was under dense evergreen forest 30 to 40 years ago.

The Grass Hills—Kornelar Valley.

A field of tea running down to a snipe swamp.

They come in late in October and when they first arrive can be found in large wisps on favourite patches of ground. I believe that many of these birds continue their migration further afield, but many split up and remain here until late April.

Many swamps which are apparently good ground never hold a bird. The birds take to the tea and scrub as soon as the sun gets hot and will not move out of it. Some of the best swamps are in very public spots where coolies are continually passing, and one of the best I know is within 100 yards of a tea factory with cooly lines all round it and a main road along one side. Few of the birds in this swamp bother to leave it at the first beat. An average morning when birds are plentiful is a bag of 5 to 6 couple to two guns shooting between 6 and 8 a.m. This snipe is also found occasionally in bogs on the Grass Hills. I have seen them there in January and February.

The Pintail Snipe. [*Capella stenura* (Bonaparte)].

This season I shot one of these birds in December in the tea district. The swamp in which it was shot was almost dry. This is the only Pintail I have seen or heard of up here.

The Wood Snipe. (*Capella nemoricola* Hodgs.).

This season in December Dr. R. M. Yeo shot a Wood Snipe whilst walking up a swamp on Pannimade Estate with me. This is the only one that has so far been recorded up here.

The swamp was a very big one which had been drained into main channels, all of which had bushy scrub growing over them as an antimalarial measure. The ground between the drains was covered with tussocky grass and low scrub. This swamp sometimes holds Fantail Snipe, but it was at the time very dry and there were none there.

We saw three Wood Snipe but did not at first realise what they were, and mistook them for Water Rails on account of their very languid flight and their curious habit of flopping into scrub cover. After shooting one we tried to put the others up again, but in spite of having a dog we only got one of them to move. This flew a short way before going down again for good and never gave a fair shot. These three birds were scattered at some distance from each other over an area of about 10 acres.

Woodcock. (*Scolopax rusticola* Linn.).

There are only two records of this bird having been shot up here. The first was shot by the late Mr. Cooper on Castlecroft Estate in the tea some years ago. This year another was shot by Mr. G. B. Reade on the Grass Hills. It was beaten out of a small patch of sholah between 6,000 and 7,000 ft. up, and was the only one seen.

Jungle Fowl. (*Gallus sonneratii* Temm.).

Grey hackle jungle fowl are common all over these hills at all elevations. They do not seem to have a very clearly defined breeding season. The bulk of the chicks are hatched out in April, May and June in the tea district, but I have seen chicks in the tea in November, December and January. It is curious that, like so many of our birds and animals in this area, the young should be brought into the world to face the very inclement weather of our S.W. monsoon soon after they are born. I imagine that the reason for this is that the food supply in the form of insects, seeds, and vegetation is most abundant in the month or two preceding the monsoon, when all plant life wakes up under the stimulation of warm showers following several dry months.

Spur Fowl. [*Galloperdix spadicea* (Gmelin.)].

The red-legged spur fowl is not common, and does not seem either to increase or decrease in numbers. It is scattered throughout the area.

Quail.

I have seen occasional small coveys of five or six birds in the short grass on the lower slopes of the Grass Hills at 5,000-6,000 ft. I am not sure which variety this is as I have had very little experience of quail. The bird is dark between the colour of a grouse and a partridge. It is also bigger than the lighter coloured bird which is so common in the foot-hills.

As mentioned in my note I am not quite sure which variety of quail this is. The following might be added to this note.

This quail is probably either the Common Quail or the Rain Quail. Two years ago a pair of these birds nested in April in the garden of the bungalow of Akkamallai Estate. The nest was built under a large white lantana bush and the chicks were hatched out successfully. Akkamallai Estate is a tea estate which runs up to the foot of the Grass Hills and the elevation of the bungalow is about 6,000 ft.

The Quail is I think a resident bird as I have seen them at various times of the year, both in the dry weather and in the S.W. monsoon which is very heavy on these hills.

Imperial Pigeon. [*Ducula badia cuprea* (Jerd.)].

These birds are very common all over the area, both in the tea district and in the Grass Hills. In the tea district they live in the tops of very tall trees, on whose fruits they feed. They are particularly partial to the fruit of the Dammar tree (Tamil, *Kungele Maram*) from which comes the Dammar gum of commerce. This fruit is like a fair-sized blue plum, and has a thin rind with a hard stone centre. Half a dozen of these—each fruit as big as the bird's own head—can be squeezed out of the crop of a dead bird. The Imperial Pigeon has an articulated jaw which allows the beak to gape to an incredible extent, and this explains the apparent miracle. I have never discovered what the bird does with the stones which are about three-quarters of the fruit, but presumably it regurgitates them in due course.

These birds have very definite flight lines between their roosting and feeding grounds every morning and evening. They stick to these year after year, and only vary them as different patches of jungle come into fruit. As a rule they fly in batches of anything from three or four to eight or ten birds at a time. They are generally only in range where the lines cross the top of a hill, and if shot at too much they will come over much too high to be touched. These flight lines are often some miles in length. The birds start to flight in to feed soon after dawn and go out to roost again about 9 a.m., repeating the performance again in the evening between 4 p.m. and dusk. They have exceedingly good eyesight and will spot a gun or any movement from a long way off, when they will immediately zoom upwards and pass over well out of range. Absolute stillness and some sort of protective hide are essential for a successful shoot.

In the S.W. monsoon most of the birds from the Grass Hills come down to lower levels, but they nest all over the hills in patches of sholah from March to May. By the second week in May most of the young birds are on the wing. The peculiar acrobatic soar and dive which is supposed to be a mating display can be seen at any time of the year. I saw some birds performing in late May this year after the nesting season was over, and I fancy it is just an expression of exuberance similar to the antics of tumbler pigeons.

These birds seem to prefer the highest trees they can find both for feeding and roosting, but I have twice put up Imperial Pigeons off the ground. On both occasions there were several young birds together which had apparently been resting on the ground under heavy jungle during the daytime. I do not think an old bird ever comes to earth except when brought there by a gun.

Nilgiri Wood Pigeon. [*Columba elphinstonii* (Sykes)].

This bird is common in the small sholahs on the Grass Hills but is only occasionally seen lower down. It sticks to the higher elevations all through the year. Some years ago I got into a camp late one evening on the Grass Hills and used an old derelict grass hut as shelter for the night. I was startled out of my sleep at dawn the next morning by about a dozen Nilgiri pigeons which unnoticed by me were already using the roof trusses as a roost when I got in, and had not been disturbed by my arrival. For a moment I thought the place was bewitched. A bilberry tree outside was providing their food.

Whistling Green Pigeon. [*Crocopus phoenicopterus chlorogaster* (Blyth.)].

These birds are migratory and are common all through our dryer months, sometimes in larger flocks. A few birds are occasionally seen during our rains but they never stop long in one place. They feed on small berries and figs of various kinds. I have never seen or heard any of these birds on the Grass Hills.

The plumage of the sexes is different. One bird which I believe to be the hen is a pale yellow green all over with a few dull bluish feathers. The other is much brighter coloured with very pretty yellow and reddy brown wing feathers.

I have seen another and larger species of green pigeon in the deciduous bamboo forest of the foot hills near the Chinnar river at the foot of the Munnar-Udamalpet ghat. This bird was much larger, greyer in colour, and had a louder whistling call.

Bronze Wing Dove. [*Chalcophaps indica* (Linn.)].

These birds are common all over our hills. Unlike all our other pigeons, except the common dove, they are largely ground feeders. They are usually seen singly or in pairs strutting about the roadsides or in light undergrowth. They are very fast on the wing and very good eating when shot. Their favourite food in the planted area is the small seed of a quick growing secondary jungle tree whose Tamil name is *Wattagunny*. They sometimes perch in the tree itself but prefer to pick up the fallen seed off the ground.

They are migratory and leave us during the heavy rains but often reappear before the monsoon has quite finished. Their reappearance is a welcome indication that the monsoon is nearly over.

Although outside the subject of Game Birds it is of interest to record that there are no crows or jackals either in the Anamallai Tea District or in the Grass Hills this side of the Travancore boundary. An occasional crow is blown up here in a storm and several have been released by mischievous coolies at various times. They have hung about for a few days getting hoarser and hoarser and have then disappeared. There are plenty within a few miles at the foot of our ghat, and also throughout the jungle to the West around the timber depot of Mount Stewart. I have been told that there are jackals on the grass land in the High Range which is all part of the same stretch as our Grass Hills without any geographical bar to emigration. There are any number in the foot hills and low country to the North and West.

No one has ever satisfactorily explained these two mysteries. It is probable that there was nothing for either crows or jackals to feed on in the days when the whole area was dense and uninhabited evergreen forest but the Tea District has now been opened and well populated for a number of years.

(2) THE LOW COUNTRY AREA AROUND COIMBATORE, POLLACHI, UDAMALPET, AND KOLLENGODE, AND THE FOOT HILLS OF THE ANAIMALAI HILLS

The shooting in the low country is either tank shooting or walking up snipe. Ground game are found in the foot hills.

Snipe are nowhere very plentiful, but with the help of a good shikari quite good shooting can be had. There is a large acreage of paddy round Anaimalai village to which quite a number of birds come, but they only frequent small patches at a time and are always moving their feeding grounds. Without the help of a shikari to do the advance spotting it is possible to walk all day and pick up very few birds. Similar shooting is to be had in the paddy round Coimbatore and Podanur. The paddy which is irrigated from the tanks round Udamalpet holds very few snipe and they are only to be found here in one or two small patches. The soil here is black cotton soil and it would seem that they do not care for it as a feeding ground.

Snipe are usually to be found round the margins of the tanks feeding in the morning and the evening but they leave these grounds between 9 a.m. and 4 p.m. probably on account of the cattle which graze there in the daytime. One or two of the river beds hold quite a number of snipe during the heat of the day. They lie up here in patches of screw pine and rushes, on islands in the stream, and under scrub on the banks. This shooting is hard work but good fun.

The birds arrive in late October or the beginning of November and stop until the end of March or the beginning of April.

Fantail Snipe. [*Capella gallinago* (Linn.)].

This is the commonest snipe throughout the area. Other snipe are comparatively rare. Fifteen couple between two or three guns shooting morning and evening is a good day's bag.

Pintail Snipe. [*Capella stenura* (Bonaparte)].

This snipe is uncommon and I have seen very few shot. When shot at they often leave the wet land and settle on the dry cultivation nearby.

Painted Snipe. [*Rostratula benghalensis* (Linn.)].

The Painted Snipe although not common is not the rarity that it seems to be in some places. It is not unusual to have several of these birds in the day's bag. They are generally found round the edges of the tanks late in the season in February and March. When put up they do not go very far before settling again and are slow on the wing, for which reason they are often missed. Contrary to the general belief they are quite good eating.

Ducks and other Tank Birds.

The duck shooting on the tanks at the foot of these hills used to be very good. In late April 1925, four guns had a bag of some 80 head in two hours' shooting. Since that time the shooting has got steadily worse, and at present a lot of local knowledge and cunning is necessary for even a poor bag. I don't think that the actual numbers of duck, except in the case of Cotton Teal, have fallen off very much but they get no rest and are much more difficult to get near. The increase of local guns is of course responsible. On most tanks guns can be heard every morning and evening. I had an object lesson from one of these gentlemen on how to shoot birds on the water. He stalked a bunch of five teal feeding at the edge of the tank. When he got within range he flattened himself out and fired his gun parallel to and just above the surface of the water getting four birds, all hit in the head, a much more effective method than trying to fire down on them.

Ducks on these tanks feed most of the night and are still feeding at dawn. If shot at between dawn and 8.30 they do not immediately clear off the tank. By 8.30 they have finished feeding and are resting on the open water. If shot at then they will probably clear straight off to a safer spot. On a dull and stormy day they will start to move again to their feeding grounds about 4 o'clock in the afternoon, but as a rule they do not move until just before dusk.

At Udamalpet there is a very big tank which is nearly all open water, with six or seven small tanks close to it. The big tank is a safe refuge when they are disturbed and for resting on during the day. They flight off to feed on the smaller tanks in the evening. The flight lines on and off the small tanks are always the same but the birds are by no means regular in their choice of tank for feeding. Duck start to arrive about the beginning of November, the first to come in being the Garganey Teal and the Spot Bill. They do not come in in any numbers until late November or December and they stay in spite of guns and drying tanks until late April. When they are getting ready to go they congregate in large numbers for a day or two in selected spots.

Garganey Teal. [*Querquedula querquedula* (Linn.)].

This is by far the commonest of our ducks and makes up about 75 per cent. of a day's bag. At one time Cotton Teal were about as numerous but their numbers have dwindled tremendously of recent years.

Common Teal. [*Nettion crecca crecca* (Linn.)].

This teal is very uncommon. The only one I have shot was a female in January 1936. I have seen one or two more.

Cotton Teal or **Pigmy Goose** (*Nettapus coromandelianus* Gemlin).

The Cotton Teal used to be as common as the Garganey a few years ago but its habit of hanging round the edges of tanks has caused its decimation by local guns of recent years. When shot at it will often take to stream beds and irrigation channels. It is the only one of our ducks that seems to do so.

Whistling Teal. [*Dendrocygna javanica* (Horsf.)].

Whistling Teal used to be fairly common but I have not seen one for some years.

Spot Bill Duck. (*Anas poecilorhyncha poecilorhyncha* Forster).

This duck used to be fairly common but seems to have decreased in numbers of recent years. It is the first of our big ducks to arrive in November.

Mallard. (*Anas platyrhyncha* Linn.).

Mallard are very rare. I have only seen one, and have heard of one other being seen.

Brahminy Duck. [*Casarca ferruginea* (Vroeg.)].

I have never seen one of these ducks but one was shot a year or two ago.

Pintail. [*Dafila acuta* (Linn.)].

The Pintail is fairly common and seems to have increased in numbers in recent years.

Shoveller. [*Spatula clypeata* (Linn.)].

This duck is also fairly common particularly on the Udamalpet tanks. The prejudice against it as a table bird is unjustified.

One or two other ducks have been shot on shoots that I have at, but as I have been unable to identify them definitely I have not included them in this list.

Geese.

Until this season no goose had been recorded from the tanks in this area.

Last Christmas (1936) at a shoot on the Summatur tank near Pollachi we were surprised to see a solitary goose flying up and down the tank. We spent some time trying to get a shot at it but it never gave any of us a chance and eventually flew off following the river into the foot hills.

Some doubt was cast upon our tale, as is only natural, but having seen plenty of geese elsewhere I have no doubt on the subject. As far as it is possible to guess at its identity in the air it was probably a Bar Headed Goose. The appearance of the bird caused a sensation and much excitement amongst the local inhabitants some of whom were fishing for Murrel in the rushes just behind me. They had evidently never seen anything like it before.

Flamingoe. (*Phoenicopterus ruber* Linn.).

In March 1931 I shot a Flamingo on the small tank at Dhali near Udamalpet. Two of us were waiting on a flight line for teal and it got out of some tall rushes close to me when my companion fired his first shot. It was a young bird and is the only one I have seen or heard of here. The forest guard who ate it was very, very bilious afterwards.

White Ibis. [*Threskiornis melanocephalus* (Lath.)].

This season I shot a White Ibis, one of a pair on the Anamallai tank near Anamallai village in November. Unfortunately it was too far gone to sample on the table when I got home.

Black Ibis. [*Pseudibis papillosus* (Temm.)].

These birds are often seen hanging round any of the tanks in the area, generally in pairs. I am told that they are very good eating.

Pheasant-tailed Jackana. [*Hydrophasianus chirurgus* (Scop.)].

This season a pair of these curious birds were seen on the Vallyavutty tank near Udamalpet. The tank was almost dry and the birds were walking about in the shallow water.

A PRELIMINARY ACCOUNT OF THE APHIDIDAE OF POONA

BY

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The aphididae of Poona are insects that have been very little collected and about which very little is known. The group, even in India as a whole, is very little studied. The lack of information is not, however due to any lack of importance. The aphids are widely known as one of the worst of agricultural pests and, particularly so, on account of their excessive and rapid power of multiplication. The life of these insects is also very peculiar. There are dimorphic forms—alate and apterous—of which the apterous ones are the most important from the eceonomic point of view. The apterous females reproduce parthenogenetically and viviparously and thus their multiplication goes on by leaps and bounds. Some of these apterous females develop wings and reproduce their kind parthenogenetically and viviparously. The alate forms are principally concerned in the spread of infection from plant to plant while the intensity of damage depends upon the apterous colonies. The usual period of activity of aphids is from July to February; however, some species are found in the summer months also. The cold of winter appears to have no effect on their breeding and growth. There is no sexual generation observed in this part of India. Males are absent and no eggs have been noticed.

The damage done by the aphids is principally by the withdrawal of the sap from the shoots and leaves which consequently shrivel and wither. The aphids are very potential pests and if not checked in time a great deal of damage is done. They have been found to attack various crops—annuals and perennials. The citrus trees, as soon as the new shoots are thrown out in February and March are very seriously attacked, which results in checking the bearing. Mango shoots are observed sometimes to be full of aphids in February and March and a serious attack is bound to affect the bearing of fruits. Various vegetables and pulses are invariably attacked during the monsoon and afterwards. Betelvine, tobacco, cotton and chillies do not also escape the attack of aphids. In this way examples can be multiplied to show that aphids are a universal pest. Some species are specific pest of certain crops, while others are polyphagous and there are other species like *Myzus* sp. which is said to have about 35 different hosts. In short, considering the longer period of activity, their feeding habits, and the nature of damage caused by them, aphids occupy an important place among the major pests of agricultural crops and orchard trees and a complete knowledge of their life and behaviour is absolutely necessary both from the academic and economic points of view. The writer has been investigating the problem of control of the cabbage aphids and in the course of his studies he has collected aphids on different plants and vegetables in order to find out the alternate hosts. This collection was sent to Dr. P. W. Mason, Bureau of Entomology, Washington, D.C., U.S.A. for identification and the writer acknowledges with thanks the help rendered by him in this connection.

Though the aphids are an important pest, knowledge about their classification is very meagre. The only literature dealing with Indian species is *The Memoir of the Indian Museum* on 'The Aphididae of Lahore' by Das (1918). The identification received from Dr. Mason was generally useful in placing the species in their proper places, but it must be said that many of the identifications done by the writer agree with those given by Das.

Thanks are due to Dr. K. R. Karandikar, Ph.D. for going through the manuscript and making some useful suggestions.

The following is the preliminary account of the species collected by the writer during the last four years :—

A. TRIBE : **Callipterini**

(1) *Therioaphis ononidis* Kalt.

Young	...	Yellow and gray
Adult[1]	...	Gray
Pygidium	...	Gray
Cornicles	...	Dark

Host plant—Lucerne (*Medicago sativa*).

This species has been named by Das as *Callipterus trifolii* Monell. Lucerne appears to be the only host plant in the Deccan as the species has not been collected on any other leguminous plant. Both alate and apterous forms can be recognised by the pale yellow or gray colour and by the two rows of dusky spots on the back. The body with the dusky spots looks 'mouse like'. The attack is generally bad in summer months, but the insects have been observed in earlier months also. The anal plate is deeply bifid forming two long narrow lobes.

B. TRIBE : **Aphidini**

I. SUB-TRIBE : MACROSIPHINA

(2) *Myzus persicae* Sulz.

Adult	...	Greenish yellow
Young	...	Pale green
Pygidium	...	Greenish yellow
Cornicles	...	Dark (especiially in alate forms).

Host plants—Cabbage, radish, brinjals, potato, chillies, lettuce, shepu, etc.

This species is greenish yellow in colour, large in size and is easily recognised by the prominent pointed tubercles which are strongly converging, and the small cauda. The alate females have dark patches on the back. This is usually known as *radish aphis* as it appears at its earliest on this crop in the month of August from where it spreads to other plants.

(3) *Macrosiphum pisi* Kalt.

Adult	...	Green
Young	...	Green
Pygidium	...	Green
Cornicles	...	Yellowish green with the tips dark

Host plant—Sweet peas (*Pisum sativum*).

The genus *Macrosiphum* can be distinguished from the genus *Myzus* by the strongly diverging frontal tubercles and the elongate cauda. This species is invariably found on peas from October till February at Mahableshwar and in the plains. The aphis is large in size, green in colour and spindle-shaped in form, smooth in texture. The legs are green, the cauda and cornicles long. These aphids, especially the adults, fall down on the soil at the slightest touch, and are found on older leaves oftener than on young shoots.

(4) *Macrosiphum* sp.

Adult	...	Reddish brown
Young	...	Red
Pygidium	...	Red
Cornicles	...	Reddish brown.

Host plant—Shevanti (*Chrysanthemum* sp.).

This species has been identified by Dr. Mason as *Macrosiphonella sanborni*. It has been observed on the Chrysanthemum plants in October and is always confined to the young shoots which consequently get stunted.

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[1] The term Adult in this description refers to the apterous form.

II. Sub-tribe : Aphidina

(5) *Siphocoryne indobrassicae* Das

Young	... Yellow and green
Adult	... Bluish green
Pygidium	... Dark
Cornicles	... Dark

Host plants—Cabbage, knolkhol, cauliflower, mogri (a kind of radish), turnips.

This species is invariably found on cabbage. The first appearance is in October, on seedlings, as soon as the cold weather sets in. It continues to breed till March when it disappears. It becomes a serious pest if not checked in time.

This species has been identified by Dr. Mason as *Rhopalosiphum pseudobrassicae* (Davis) Das (**1**) has discussed on page 173 of his *Memoir* the history of the names *Rhopalosiphum* and *Siphocoryne* and the characters of *Siphocoryne* given by Van der Goot and Das are as follows :—

(1) Frontal tubercles indistinct.
(2) Sensoria in the apterous females always absent.
(3) Cornicles clubbed in both—apterous and alate forms.

Those agree in the case of the species found in Poona and hence it has been put under *Siphocoryne*.

(6) *Siphocoryne avenae* Fabr.

Adult	... (Winged) dark
Young	... Not found
Cornicles	... Dark brown

Host plant—Tobacco (*Nicotiana tabacum*).

This appears in Poona in the month of November. Only alate forms are found on leaves. Apterous forms and the young ones are not observed on plants.

(7) *Aphis sacchari* Zehut

Adult	... Pink
Young	... Almond yellow and pink
Pygidium	... Black
Cornicles	... Black

Host plants—Jowar, maize, bajri, rala, etc.

This species has been observed in Poona in the month of August on the underside of the leaves of maize and jowar. In the colonies are found insects of two different colours, whitish yellow and pink. These are attended on by large black ants. The black sooty mould grows profusely in the honey dew secreted by the insects and the leaves become dark in colour.

(8) *Aphis maidis* Fitch.

Young	... Green or pale green
Pygidium	... Greyish dark
Cornicles	... Dark

Host plant—Jowar.

Along with the previous species this aphis is also observed on jowar shoots in August. This can be recognised by the colour, which is blue-green.

(9) *Aphis gossypii* Glover

Young	... Yellow
Adult	... Dark (Pupa—dark)
Pygidium	... Dark
Cornicles	... Dark

Host plants—Cotton, bhendi and hollyhock.

This aphis persists on cotton right from August to March. The yellow colour sometimes changes to greenish dark, hence there is ground for confusion about the proper identification, as this then resembles the next species.

If the attack is very bad in the very early stage of the crop, the leaves curl and the crop shows signs of withering.

(10) *Aphis malvae* Koch

Young	... Yellow, pale white
Adult	... Alate dark, apterous—greenish dark
Pygidium	... Dusky
Cornicles	... Dark

Host plants—Cucumber, pumpkin, kohla, dodka, snake gourd, bottle gourd, parwar, tondali, karli, etc.

This species has been observed on these plants mainly in the monsoon and also on melons in the summer months. It is sometimes a serious pest and the crop suffers a great deal. The yellow colour of the young changes to dark green ; and the alate forms are dark coloured.

(11) *Aphis medicaginis,* Koch

Young	... Dark reddish brown
Adult	... Reddish brown—full grown apterous adults with shining black spots on the back.
Pygidium	... As the body colour—black
Cornicles	... Black

Host plants—Wal, chavali, ghevda.

All the species collected on different leguminous crops were sent to Dr. Mason who identified them all as *Aphis rumicis.* The characters of *Aphis rumicis* given by Das and Theobald are :—

(1) Body dull black to dark greenish
(2) Post cornicular segments striped
(3) Forms pseudo galls

While those of *A. medicaginis*

(1) Body in the adult apterous female with a large shining black spot on back.

The colour, other characters, and particularly the habit of forming pseudo galls on leaves so characteristic of *A. rumicis,* are not noticed here and therefore *A. medicaginis* appears to be the correct identification. The chief characteristic of the apterous females consists in having a shining black spot on the back. Besides, the whitish patch on the femora and the tibia is also a special feature. Van der Goot proposes the name *A. papilionacearum* which has been accepted by Das.

This species is sometimes a serious pest of bean which suffers a serious set back in growth and bearing.

(1) *Aphis nerii* (Boyer de Fonscolombe).

Young	... Deep yellow
Adult	... Yellow
Pygidium	... Yellow
Cornicles	... Dark

Host plant—Rui (*Calotropis gigantea*).

This species is most abundantly found on the veins and leaf stalks of Rui from August to February. All the lower leaves are covered with honey dew and the *capnodium* fungus growing on the secretion.

(13) *Aphis* sp.

Young	... Reddish pink
Adult	... Pink
Pygidium	... Dark, conspicuously long
Cornicles	... Dark brown

Host plant—Mango (*Mangifera indica*).

This species is found on young shoots and leaves of mango. This has been observed in November as well as in March. The alate form is pink in colour; antennae dark, legs pale white except at the femora and tarsi, cornicles and cauda dark. The apterous form pink in colour, thorax waxy white, antennae white except at the tips, cauda hirsute, cornicles dark, abdomen punctured laterally on both the sides.

(14) *Aphis* sp.

Young	... Dark
Adult	... Dark
Pygidium	... Dark
Cornicles	... Dark

Host plant—Safflower.

This species has been observed on safflower from November to January. This aphis is dark in colour and infests all shoots and leaves. The multiplication is very rapid and the honey dew secretion so profuse that the whole plant gets covered with the sticky substance and the numerous moults of the aphids.

(15) *Toxoptera aŭrantii* Koch.

Young	... Deep yellow turning brown
Adult	... Shining dark
Pygidium	... Dark
Cornicles	... Dark

Host plants—Mosambi, utaran, sour lime, grape fruit, jamburi, orange, etc.

All the species collected on different citrus plants have been identified by Dr. Mason as *Aphis citricidus*. This does not appear to be correct. The genus *Aphis* is distinguished from the genus *Toxoptera* by the branching of the *vein media* in the fore wing. In *Toxoptera* it is once-branched, while in *Aphis* it is twice-branched. The wing venation of the species found on citrus plants in the Deccan agrees with that of *Toxoptera* and not with *Aphis*. As to the specific name it appears to be a new one. Das states that *Toxoptera aurantii* is sparsely found on citrus plants in Lahore, but in the Bombay Presidency it is abundantly found. This has been noticed from September till March and attacks especially the young shoots.

This species is synonymous with *Ceylonia theacola* Buckton and has been mentioned in the *Indian Museum Notes*, vol. ii, No. 1 as occurring on tea bushes.

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SOME ADDITIONS TO THE FAUNA OF IRAQ.

By

Walter P. Kennedy.

(From the Royal College of Medicine, Baghdad, Iraq).

Between 1920 and 1922 a series of papers were published in this *Journal* on the fauna of Iraq and Persia. Excellent as this work was, it was not exhaustive, and some lacunae remained. So when in the course of certain other investigations a rather heterogeneous collection of specimens was gathered, it was thought that the interesting nature of the region justified publishing some notes, even though the information was only scanty. Some further indications might at least be given for other workers in the future.

MOLLUSCA

Diotocardia.

Neritina macrii Recluz. var. *minor*.
From Kani Tili in Kurdistan, 37° 11″N. 43° 38″E.

Monotocardia.

Melanopsis nodosa, Fer.
Several localities in immediate neighbourhood of Baghdad.

Basommatophora.

Limnaea tenera euphratica, Mousson.
Near Baghdad.
Bulinus truncatus, Aud.
Khan beni Saad, a village about 20 miles from Baghdad, incidentally heavily infected with Schistosomiasis.

Stylommatophora.

Xerophila vestalis, Parreyss.
Haruna, 36° 57″N. 44° 25″E.
Pomatia salomonica, Naegele.
Renji Brakha, 37° 06″N. 43° 54″E.

Cardiacea.

Cardium edule.
Lake near Kerbala.
Further notes on molluscs in Iraq will be found in a paper by Mills, MacHattie and Chadwick.

ARTHROPODA

Myriapoda.

Scolopendra morsitans.
Baquaba and Nasiriyah. Cases of poisoning are reported from this type.

Scorpionidea.

Buthus (Prionurus) crassicauda, Olivier.
Buthus australis, Hempr. & Ehr.
Buthus eupeus, C. L. Koch.

Hemiscorpion lepturus, Peters.

B. crassicauda and *B. eupeus* are probably the commonest species of scorpions in Western Asia. They have been recorded from Afghanistan, Iran, Armenia, Syria and Arabia. *B. australis* was taken at Mandali where they are much feared as they are very toxic. *Hemiscorpion* (or *Hemiscorpius*) *lepturus* has been recorded much less frequently, and only from Baghdad and the southern parts of Iraq. I have obtained specimens from Mandali, and from Rowanduz and Sulimania in Kurdistan. Closely allied forms from Aden and Sokotra (Pocock, 1899), Muscat (Kraeplin, 1900) and E. Iran (Birula, 1903) have been described as separate species, but it seems likely that some or all of these are co-specific with *H. lepturus* of Peters. It is not a specially dangerous type. Death from scorpion stings are not unknown in Iraq, the victims being children or debilitated adults. Dohuk and Murgash, N. of Mosul; Sulimania in Kurdistan; and Mandali in Diala Liwa have evil reputations in respect of scorpions.

SOLPUGIDÆ.

Galeodellus (? species).
Galeodes ? bacilifer. Both from Asher near Basrah.

Galeodes arabs.

Specimens from Basrah, Nasiriyah, Baghdad, Baquaba in Iraq, and Isfahan in Iran. They are said to be venomous, and in Basrah and Isfahan at least, are feared. My bearer has frequently handled them freely and they have made no attempt to bite.

PISCES

SELACHII.

Carcharias lamia, Risso.

This shark was taken in a fisherman's net just above Baghdad. Sharks are not frequent visitors so high up the Tigris as Baghdad, but isolated ones are heard of every year. In the river at Basrah they are more common.

Myliobatis aquila, L.

From the mouth of the Shatt-el-Arab. These eagle rays attain a very large size in the Persian Gulf.

TELEOSTII.

Barbus luteus, Heckel.
From Tigris about Baghdad, and also in small unnamed streams in Kurdistan.

Barbus kersin, Heckel.
Tigris, above Baghdad.

Barbus subquincunciatus, Günth.
Small stream at Rayy, near Teheran.

Discognathus rufus, Heckel.
Tigris at Baghdad.

Leuciscus (? species).
Tigris at Baghdad.

Girardinus faeciloides.

Exact provenance of this specimen unknown, but probably taken in the vicinity of Baghdad.

Aspius vorax, Heckel.
Tigris at Baghdad.

Alburnus mossulensis, Heckel.
Unnamed stream in E. Kurdistan.

Alburnus (? species).
Tigris at Baghdad.

Alburnoides (? *bipunctatus*, Bl.).
Small stream at Rayy, near Teheran.

Mugil abu, Heckel.
Tigris at Amara and Baghdad.

Mugil dussumieri, Cuv. & Val.
Tigris at Amara and Baghdad.

Belone (? species).
Mouth of the Shatt-el-Arab near Fao.

Sparus berda, Forsk.
Tigris at Baghdad.

Mastacembelus (? species).
Tigris at Baghdad.

This list of fishes covers a small part of the total number, and further work is planned in this direction. It appears probable that there are two or three new species in the mullets, genus *Mugil,* and also a very great extention of range in one of the species which has hardly been recognised since the time of Forskal. There has been so little work done on the fish of this region that considerable difficulty is found in identifying the specimens. In addition to the above, representatives of *Hilsa,* and *Mystus* from Baghdad, and two species of *Varicorhinus* from Teheran and Kurdistan respectively have been tentatively identified.

AMPHIBIA

SALAMANDRIDÆ.

Triturus vittatus.
Newts are rare in Iraq. This is the only example which has been found so far as I can trace, and it only occurs in one spot, a spring, Kuni Sheikh Omar near Berisa village in Kurdistan, 36° 56″N. 44° 17″E. I am indebted to Dr. Macfadyen for this observation.

BUFONIDÆ.

Bufo viridis.
Widely spread through Iraq.

HYLIDÆ.

Hyla arborea savignyi.
Baghdad and Amara.

RANINÆ.

Rana ridibunda.
Widely spread through Iraq.

Rana ridibunda susana.
N.W. Kurdistan.

Rana esculenta.
Baghdad.

Bufo viridis is distributed from the Pyrenees to the Thibetan Himalayas, and *Rana ridibunda* from Spain to Iran, and south to Egypt. Both species are probably divisible into a number of local races, especially in the eastern part of their range, but so little is known of them in these regions that it is difficult to assign them subspecific names.

REPTILIA

GECKONIDÆ.

Phyllodactylus elisae, Werner.
Three specimens of this rare gecko were reported by Procter in 1921 from the Persian frontier. The present example was found near Table Mountain near Baquba. It was thickly speckled with dark brown,

AGAMIDÆ.

Agama persica, Blanf.

From Nasiriyah, being the most southernly record of this form. The specimen shows some differences from the typical Persian ones, but whether this indicates a subspecies difference it is not possible to determine from one specimen.

Agama agilis, Oliv.

From the Shia Khuh in the Salt Desert to the S.S.E. of Teheran, Iran.

Agama caucasica, Eichw.

Taken about 40 miles W. of Teheran.

Phrynocephalus scutellatus, Aud. (*oliveri,* Gray).

From the Shia Khuh, and also near Isfahan, Iran. At the latter a road running over a barren area had rocks and gravel on one side, and softer sandy soil on the other. *Phrynocephalus* was plentiful on the rocky side, but none were seen on the sandy side, where however, there were large numbers of *Mabuia septemtaeniata* (Fellow's skink). Neither type trespassed on the domain of the other, though separated only by a narrow road.

Uromastix loricatus, Blanf.

Porter, 1921, gives one specimen from Ruz as a new record for the country. The present specimen was brought to me by an Arab from a point he judged about 50 miles W. of Baghdad.

LACERTIDÆ.

Acanthodactylus fraseri, Boulenger.

This is, so far as I can discover, only the third known example of this species, described by Boulenger in this *Journal,* 1918. It was found at Nasiriyah.

Eremias brevirostris, Blanf.

Also from Nasiriyah, this specimen tends to show a link with *E. adramitana.*

Apathya (*Latastia*) *cappadocica urmicana,* Lantz & Suchow.

Two specimens one from the Jebel Hamrin, the other from the Rowanduz road in Kurdistan.

AMPHISBAENIDÆ.

Pachycalamus zarudyni, Nik.

This lizard was recorded by Boulenger in 1920, and it is noted again here on account of its distribution, and because it is uncommon. The specimen came from Abatia in the Southern Desert, 29° 33″N. 44° 53″E. So far as is known, no examples have been encountered near Baghdad or further north.

OPHIDIA

COLUBRIDÆ.

Lytorhynchus diadema, Dum & Bibr.

The Diademed Sand Snake is not a common snake in Iraq according to Corkill, who records three specimens from Shaiba, Falliyah, and Rutba. The present specimen was taken at Baba Gurgur, Kirkuk, by Mr. F. R. S. Henson, and thus extends the distribution of the species in this country.

Hydrophis lapemidoides, Gray.

From Bahrein Island in the Persian Gulf, and according to Malcolm Smith a rare species.

Lapemis curtus, Shaw.

Also from Bahrein Island. Smith records a specimen from Muscat, but I can find no reference to the occurrence of the type at the western end of the Gulf.

Microcephalophis gracilis, Shaw.

Brought up in a dredger bucket at Fao, mouth of the Shatt-el-arab.

CHELONIA

TESTUDINÆ.

Clemmys caspica.
The common tortoise of Iraq : several specimens taken from all over the country.

TRIONYCHODEA.

Trionyx euphraticus.
Nasiriyah and the Tigris above Baghdad, the latter specimen measures 47 cms. in length, and I have seen some considerably larger. This mud tortoise has very powerful jaws, and is reputed to inflict destructive bites on men wading or swimming.

Some of these specimens were collected while I accompanied Mr. Henry Field during part of an expedition to the Near East organised by the Field Museum of Natural History, Chicago. Several types were found by Dr. Macfadyen. Many of the identifications were made by the authorities at the British Museum. To all of these thanks are due. The paper is published by permission of the Director General of Health, Baghdad.

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MARRIAGE FLIGHT AND COLONY FOUNDING OF THE COMMON BLACK ANT [*CAMPONOTUS (TANÆMYRMEX) COMPRESSUS* LATR.]

By

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(*Parasitologist, Agricultural College, Coimbatore*).

(*With 2 text-figures*).

Introduction.

One of the commonest and most abundant of South Indian ants, the Common Black Ant, *Camponotus compressus* Latr., has been the object of observation and study by the writer for some time now; and an account of the same has been presented in a paper published in the *Bulletin of Entomological Research*, London, 1935 (vol. 25). In that paper the writer recorded the location, structure and contents of their abodes, their population and life economy, seasonal occurrence, associations and their agricultural importance together with a few facts in their life history and habits. There are still some very interesting problems such as their marriage flights, colony founding, etc., which have not hitherto received sufficient attention. Wheeler, one of the foremost among Myrmecologists, says that 'the date and form of marriage flight in ants are really specific characters and are clearly adaptations to the ecological conditions'. The writer intends in this brief note, to call attention to some peculiarities in the marriage flights, colony founding, etc., of this common species based on some recent observations.

Previous Knowledge.

Information of a most varied and interesting nature concerning the species has been published by various naturalists, but no satisfactory description of mating habits and other related phenomena has yet been furnished. Hence the evidence available on the nature of the association of the sexes and the manner of colony founding is practically non-existent. Rothney (1889) was probably the first to call attention to this habit of *C. compressus*. He merely states, however, that the sexes swarm in May or early June and take flight as soon as the sun goes down. According to Wroughton (1892) the marriage flight takes place in June after the first monsoon showers, usually in the evenings or in the night. Hingston (1923) records that he observed a number of sexual forms flying about the lamps indicating a nuptial flight. The present writer (1935) has written that the marriage flights have been observed in the evenings between 6.30 and 9 p.m. as the winged sexual forms are crepuscular. Further observations have led the writer to reconsider this question and revise his former statement in as much as he observed marriage flights occurring much earlier in the year, though the same might continue till June or even July.

MAIN FEATURES OF THE MARRIAGE FLIGHT OF *C. compressus.*

The data on mating habits and colony founding are greatly needed to throw light on the nature of association of sexes. As seen from the brief review presented above, previous investigators have not recorded any satisfactory description of the nuptial flight or copulation of this species. It is generally known that the marriage flights usually occur within definite and limited periods in the year, and the main factors that awaken the several forms to seek union on emergence from the nest are probably meteorological conditions. For over three or four years the writer has been watching colonies located permanently in certain places in order to see the initial stages of emergence of winged forms. Hundreds of times has he vainly sought to find them in the act of copulation. Times without number the writer has taken sexual forms attracted to light between May and June and rarely in July. He has also collected winged sexual forms in small numbers at other times particularly in October after the rains.

It was only in April this year that the writer was fortunate enough in witnessing the actual processes of emergence and mating. During the cool, humid afternoon of the 1st April 1936 at about half past one, the writer, in the course of a stroll in the back-yard garden of his house came upon a swarm of these ants. Many of the ants of the colony were not, at that time, out of doors. The day was particularly cloudy and there was slight drizzling with no sunshine at all from daybreak. A summary of the weather conditions as recorded in the institute for the day is furnished below.

Pressure.	Dry Bulb.	Wet bulb.	Maxm.	Minm.	Humidity.	Rainfall.
29·808	73·8	71·8	87·0F	70·6F	90	0·65

The ground was very wet as there had been heavy rains the previous evening and night. A small contingent of *C. compressus* was observed issuing from a formicary through an aperture near a masonry structure on the ground. A few large soldiers were the first to emerge and initiate the exodus. These were closely followed by a winged virgin queen with a train of other soldiers, workers of various grades and winged males. Their march around their old homestead was conspicuous in various ways. The throng looked like an unorganised and disorderly mass of workers of varying grades interspersed with winged sexual forms. The occasion seemed to be an extraordinary one since the whole company of workers was seething with excitement. They were moving restlessly about, passing and repassing their comrades. The virgin winged queen was also slowly wandering about with a peculiar jerky gait. On a detailed examination, the swarm was found to consist of one large winged virgin queen with a long and bulky abdomen, 29 winged males and 78 workers made up of 40 large soldiers, 20 workers major, 10 workers media and 8 workers minor. The winged queen evidently happened to be the centre of attraction and the rest appeared to recognise the 'sanctity' of their charge as displayed by their extreme alertness. The workers, particularly the soldiers, never strayed beyond a small radius round about in the vicinity of the sexual winged forms.

For about a couple of minutes after emergence the males seemed to be utterly oblivious to the presence of the queen. By this time the queen was surrounded by a group of three to four males. There was no recourse to any kind of courting. The males simply crowded round her and each in its own way clumsily attempted to mount on her back. The queen's reaction was to move about with a view to avoid these overtures. At last one persistent male succeeded in its attempt and mounted on her back with its legs encircling her body. The male's abdomen was raised, the abdominal tip being bent and lowered on to the larger abdomen of the female and the connection was so effected. There was no attempt at flight throughout the act. It demonstrates that mating can take place on the ground near the nest. The actual process of copulation lasted for nearly two to three minutes; the queen then slowly slipped out and separated herself from the grip of the male. Within a minute after copulation she shed her large gauzy wings and converted herself into a dealated queen.

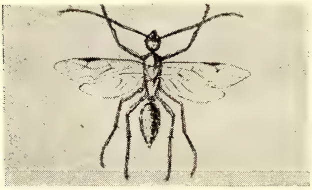

Fig. 1.—Winged male of the Common Black Ant (*Camponotus compressus* Latr.)

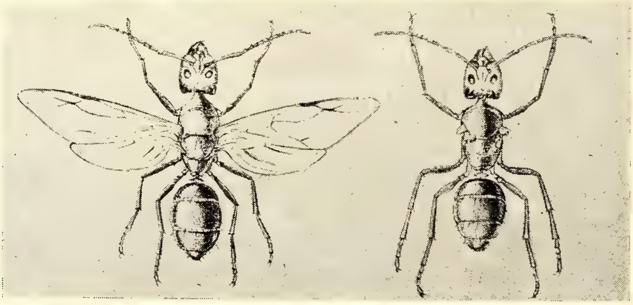

Fig. 2.—Queen. Common Black Ant (*C. compressus* Latr.) in virgin state and on shedding her wings after copulation.

The impregnated queen seemed to be taken extra care of by the workers. She was closely watched, followed and protected by the large soldiers. Attempts to capture the queen by the writer were greatly resented and were frustrated many times by the fierce fight put up by the excited and angry crowd. Every time, the ants rushed on the intruder furiously with open and outstretched mandibles, and inflicted severe bites, infusing the wound with a drop of formic acid from the abdominal extremity. Their watchfulness did not abate even after the queen had been imprisoned in a specimen tube. The tube was wrapped in tissue paper and laid nearby while the writer was engaged in watching other colonies. The fury of the retinue was directed to the tube and the wrapping was torn off to some extent and every attempt to liberate the royal prisoner were made. They remained in this highly excited and angry mood for very nearly half an hour and then slowly departed into the nest. But for a considerable length of time afterwards they continued to emerge again and again probably in their endeavour to make a vain search for their lost queen.

COLONY FOUNDING.

A careful search of other nests in the locality showed that sexual forms had also emerged simultaneously in a few others. The number of sexual forms and the proportion of workers seemed, from a few rough computation, to vary within a wide range. In one case, probably after terrestrial mating, the soldiers with unlocked mandibles seized the wings of the fecundated queen and pulled them off violently. They later on virtually dragged her back into the parental nest. Two dealated queens attended by a large retinue of workers were observed in one case. A few other dealated queens were seen, accompanied by groups of workers at some distance from original nests and these had disappeared probably by migrating in a body to adjacent situations to start perhaps fresh branch colonies. There was not a single case of flight by the winged sexual forms. But at night, on the same date, the writer was successful in collecting a few winged forms which were attracted to ordinary lights. Evidently there had been an actual marriage flight.

These observations afford an insight into some interesting habits of *C. compressus* in regard to mating and colony founding. Terrestrial mating may occur just outside the parental nest and can take place early in an afternoon provided the environmental conditions are favourable. The queen thus fecundated has the option of either returning to the old homestead or of starting, by short migrations, a fresh branch-nest probably aided by her retinue of workers. As is evidenced by real marriage flights after dusk the sexual forms of different colonies in the locality have chances of mating on the wing, in which cases the fecundated queen can start fresh colonies almost unaided. It may also be inferred from the presence of more than one dealated queen in a fresh colony that a few fecundated queens may co-operate in founding fresh colonies. Evidence on this last method may be adduced from the following observation on a caged queen kept in the laboratory.

LIFE HISTORY NOTES.

From one of the swarms found emerging on the 1st April 1936 a virgin winged queen after impregnation on the ground outside the nest was from that date kept isolated in a small glass jar in company with the lucky male and a few workers of various grades. These were kept without any supply of food or even water. The queen divested herself of her wings in a few minutes. On the second day the male with the wings intact was found dead. The workers began to die one after another and by the tenth of the month there was no worker left alive. By this time the fecundated queen showed a slight distention of the gaster. Very little attention was paid to the cage because no supply of either food or water had to be made. On the 15th of the month the queen was found to have laid a first batch of five eggs. On the 16th eight more eggs were laid. These were carefully looked after by the queen mother; they were collected together, constantly licked and transported by her between her mandibles. On the 20th morning two of the eggs were noted to have hatched. The next day the two larvæ were observed to be of unequal size one being comparatively much larger than the other. The larvæ were also continuously fed on saliva, licked and groomed by the parent. On the 22nd of the month two more eggs hatched. The larger larva began cocooning between the smooth sides of the jar on the 24th. The other grub also commenced the process of spinning on the 27th. Meanwhile one or two more eggs had hatched. The cocooned specimens were very much undersized and these were carried by the mother to different parts of the jar. Though this time she attended to her own toilet, cleaning her antennae with her front legs and cleaning these in their turn by drawing them up between the maxillæ. By this time all the unhatched eggs and the small grubs were found missing having been consumed by the mother. On the 9th May 1936 a small worker adult was dragged out by the parent after cutting open the cocoon. It was yellowish white in colour to begin with, later on became brown and assumed the dark colour on the second day. The queen apparently looked healthy though languid and her bulk had gradually decreased. The queen eventually died on the 15th of the month and the other worker failed to emerge from the cocoon.

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DESCRIPTION OF A NEW SPECIES OF AGAMID LIZARD FROM UPPER BURMA.

By

Malcolm Smith, m.r.c.s.

[*From the Dept. of Zoology, British Museum* (*Natural History*)].

Japalura kaulbacki, sp. nov.

Type immature male, taken in the Nam Tamai Valley, Burma-Tibet border, at 3,500 feet altitude, by Mr. Ronald Kaulback, after whom I have pleasure in naming it.

Length of head one and a half times its breadth; snout longer than the orbit; forehead concave; canthus rostralis and supraciliary edge sharp; cheeks swollen; upper head shields unequal, keeled, the larger ones forming a λ-shaped pattern on the forehead; occiput with spinose tubercles, namely an incomplete row parallel with the nuchal crest, and two or three more just above the tympanum, the diameter of which is one-third that of the orbit. Body compressed; dorsal scales unequal, moderately sized ones intermixed with much larger ones, the latter numerous and more strongly keeled, but not arranged in any regular pattern; the upper scales pointing upwards and backwards, the lower downwards and backwards; ventrals strongly keeled, smaller than the dorsals. A projecting fold of skin from behind the jaw to above the shoulder. Scales on the lower jaw and cheeks large, the largest as big as the large dorsals. No proper gular pouch, but a sharply defined triangular patch of skin covered with very small scales in its place. Nuchal crest low, composed of nine lanceolate scales; dorsal crest a mere ridge. Limbs rather weak, the hinder one reaching to beyond the ear; third and fourth toes equal. Tail swollen at the base, covered with large keeled scales, those of the median row above larger than the others and forming a denticulated ridge.

Colour in formalin: dark greyish brown, lighter below; gular patch blackish.

From snout to vent 70; tail 125 mm.

Japalura kaulbacki has affinities with *J. dymondi* and with the aberrant *Calotes kakhienensis*, from both of which it differs in the character of the gular scales, the enlarged dorsal scales, and in colour pattern.

BUTTERFLIES AND MOTHS FROM CHINESE TURKESTAN.

BY

LT.-COL. J. W. THOMSON-GLOVER.

The material on which this list is based is not very extensive, and merely indicates how much work remains to be done. Much ground has not been visited at all, and places visited were only worked for a brief part of the Entomological season. A glance at Seitz's volumes which contain the results of the work of many Russian collectors will show how many species and varieties may be found in this Province.

Captain G. Sherriff while touring in connection with his Consular duties collected Butterflies in the Tekkes Valley and Tian Shan Mountains in 1928.

He also sent to Bombay a collection made in the Tekkes area in 1929. (Collected perhaps when the late Mr. F. Williamson, I.C.S., was on tour there.) Others from the Kaying Bashi Valley (some 70-80 miles south of Kashgar) in 1929, and lastly from Bostan Terrek. Specimens which reached Bombay in September and October 1930.

I also visited the Bostan Terek Valley which lies some 60 miles W.S.-W. of Kashgar for two weeks in August 1934 and again in July 1935. Moths were collected during 1934 and 1935 in the Consulate Garden, Kashgar, 4,320 ft. and Bostan Terek at 6,500 ft. and 7,500 ft. As a matter of interest I have included the *Lepidoptera* collected by Stolickza within the limits of the Province in 1873, 1874. These are shewn in brackets.

The Province adjoins Indian and Tibetan territory on the south; but the most noticeable feature is that the forms met with are almost entirely Palaearctic; the same is noticeable as regards birds and plants. As might be expected *vis a vis* India the types found are closest to those from the Shandur Pass in Chitral, and the Gilgit and Hunza Valleys. A list of those collected on the journey from Srinagar to Kashgar is appended. From Murkushi in Hunza until five stages from Kashgar no butterflies or moths were seen in October 1933.

The next most striking feature is the scarcity of butterflies found in the plains of the South from Karashahr to Kashgar and Yarkand. This may be due to the salt soil, and muddy water whereby suitable food plants and flowers are lacking.

The season for entomology is limited in the plains from April to September and in the hills the season is even shorter.

The most profitable area to search would certainly be the long range of Tian Shan Mountains nearly 1,000 miles from West to East and perhaps the Urumchi oases. These areas are also the richest in flora and fauna. The identification of many of the butterflies has been established through the help and kindness of the Bombay Natural History Society and of Brigadier W. H. Evans, these are marked with an asterisk.

In the arrangement of Families I have followed as far as possible that given in Seitz's volumes.

The list contains:—

Butterflies	65
Moths	70
	135

In addition I collected:—

Butterflies	2
Moths	38
Which have not been identified	40
	175

Butterflies collected from Srinagar to Kashgar via Gilgit:—

Butterflies	45
Moths	6
	51
Butterflies (not identified)	—
Moths (not identified)	26
	77

The following is a brief description of Sinkiang or 'The New Province' of China. The area comprises 445,000 square miles lying between latitude 36° and 45° and East longitude 75° and 94°.

The area sounds large but much of the centre is occupied by the dry and salt Tekla Makan Basin and Lop Nor with its marshes, the former comprises trackless deserts extending for miles while in other parts of the basin Tamarisk scrub and wild poplar are found, but even here there is little habitation or life as the water is brackish and supports chiefly horse-flies and mosquitoes.

Round the basin lie oases like Karashahr, Kuchar, Aksu, Kashgar, Yarkand and Khotan, wherein some 7,000 square miles only are cultivated at elevations from 2,000 ft. to 4,500 ft.; they depend for their existence on streams originating from the different ranges of hills, but before long these rivers disappear and are finally lost in the Great Desert of sand and none of them find their way to the sea.

The external boundaries are composed of high mountain ranges. Many peaks carry perpetual snow, the hills are frequently barren though those more favoured provide grazing for cattle and from 7,500 ft. to 9,000 ft. juniper and fir trees are found on the northern slopes.

To the South and East are the Mustagh Range, Karakoram and Kuen Lun which form the chief boundary with India and Tibet, and the Province of Kansu.

On the west the Pamirs and Alai Ranges. To the north a portion of the Tian Shan. To the north-west the Ala Tau and further north the Tarbagatai Mountains. While the Atlai Mountains on the north-east border on outer Mongolia.

The main backbone of the Tian Shan separates the north of the Province including the districts of Barkul, Kucheng, Urumchi and Ili from the south.

From Urumchi westward the oases include grassy steppes and the climate is generally colder in the north with an increased rainfall in the summer.

Around Urumchi pheasant and partridge are found in ideal cover with flowering plants in the undergrowth.

The Sacred Mountains of Bogdo Ola which rise to a snow-covered peak of 20,000 ft. look most promising ground.

In the south the climate is dry with an annual rainfall in the plains of 3 inches.

The temperature varies from 110° in the summer to 15° in the winter approximating rather to the climate of Peking, while in the north in Urumchi the cold is much more severe and may be compared with that of Harbin and temperatures descend to 30° below zero in winter.

A. RHOPALOCERA : BUTTERFLIES

1. Family: PAPILIONIDÆ.

1. GENUS: PAPILIO.

* **P. machaon ;** 8-9-28 Agiass 5,400 ft.; May-June 1929 Tekkes; 25-5-30 Kaying Bashi 11,500 ft.; August 1934 and July 1935 Bostan Terek. Not common but caterpillar found August hatched Kashgar on 22-6-35.

8. GENUS: PARNASSIUS.

* **P. apolo sibiricus :** 6-9-28 Oi Dunga (Tekkes) 6,500 ft.

* **P. discobolus :** May and June 1929 Tekkes.

* **P. actius :** 11-2-29 Kuen Lun Mts. 16,000 ft.; 14-8-34 Bostan Terek; 22-11-35 Bostan Terek. Common at foot of glacier 9,000-13,000 ft.

* **P. delphius :** May and June 1929 Tekkes.

* **P. delphius staudingeri :** July 1935 Bostan Terek 11,000-13,000 ft.

* **P. simo gylippos :** July 1935 Bostan Terek 11,000-12,500 ft.

* **P. loxias :** July 1935 Bostan Terek 11,000-13,000 ft.

2. Family: PIERIDÆ.

1. GENUS: APORIA.

* **A. crataegi :** May and June 1929 Tekkes.

2. GENUS: METAPORIA.

* **M. leucodice:** May and June 1929 Tekkes 18-8-29 Kaying Bashi 12,200 ft. Recd. 12-9-30 Bostan Terek, 5-8-34 Bostan Terek, July 1935 Bostan Terek. Very common in July; few in August.

6. Genus: Pieris.

* **P. brassicæ** : 28-5-34 Kashgar. Common in plains June-September.

* **P. rapæ** : 5-9-28 Shotta 5,700 ft.; 30-8-29 Abad. 4,650 ft.; 8-9-28 Agiass 5,400 ft. Recd. 22-10-30 Bostan, 30-7-34 Kashgar, 6-8-34 Bostan Terek 6,000 ft. Common in plains June-September (Yangi Hissar April, Aktala May 17th).

* **P. napi** : May and June Tekkes.

7. Genus: Leucochloe.

* **L. daplidice ;** 5-9-28 Shotta; 8-9-28 Agiass. Recd. 22-10-30 Bostan Terek, 14-8-34 Bostan Terek. Common 5,500-6,500 ft. (Sarikol May 2nd and 8th).

9. Genus: Synchloe.

* **S. callidice** : 22-9-28 Koksu 8,000 ft.; 13-9-28 Karajon 7,950 ft.; 17-8-29 Kaying Bashi 10,200 ft.; 15-8-34 Bostan Terek; end of July 1935 Bostan Terek (Raphani ?). Not common.

11. Genus: Euchloe.

* **E. chloridice** : 4-8-34 Bostan Terek; July 1935 Bostan Terek. Common 5,000-10,000 ft.

12. Genus: Anthocharis.

* **A. cardamines** : May and June 1929 Tekkes.

15. Genus: Baltia.

* (**B. shawii** : Aktagh north of Karakoram Pass 15,590 ft.)

20. Genus: Gonepteryx.

* **G. rhamni** : May and June 1929 Tekkes.

22. Genus: Colias.

* **C. cocandica** : 15-8-34 Bostan Terek; July 1935 Bostan Terek. Common 8,500-11,000 ft., but often difficult to catch grassy uplands. Settles on stones.

* **C. hyale** : 6-9-28 Tekkes; May and June 1929 Tekkes. Recd. 22-10-30 Bostan Terek 6,500 ft. The commonest butterfly in the plains Kashgar to Urumchi.

* ' *var.* **pallida** : Recd. 12-9-30 Bostan Terek, 25-5-34 Kashgar, 14-8-34 (Sanju October 30th, Sarikol May 2nd, Yangi Hissar April).

* **C. romanovi ?** : 8-8-34 Bostan Terek 7,000 ft. Cell spot forewing, large insect: only one caught.

* **C. epgene** : Recd. 12-9-30 Bostan Terek, 15-8-34 Bostan Terek, July 1935. Common 9,000-10,000 ft.

23. Genus: Leptidice.

* **L. sinapis**: May and June 1929 Tekkes.

4. Family: Satyridæ.

12. Genus: Erebia.

* **E. mani** : Recd. 12-9-30 Bostan Terek, 25-7-35 Bostan Terek 7,000-11,000 ft. An active insect often difficult to catch.

14. Genus: Oeneis.

* ' **O. hora verdanda '** : May and June 1929 Tekkes

15. GENUS: SATYRUS.

* **S. (Erebia) turanica jucunda**: May and June 1929 Tekkes.

* **S. (Eumenis) briseis**: 5-9-28 Aksu Tekkes; 5-9-28 Shotta.

* **S. (Eumenis) heidenreichii**: Recd. 2-9-30 Bostan Terek, 6-8-34 Bostan Terek, July 1935 Bostan Terek. Very common 6,000-8,000 ft.

* **S. (Karanasa) geyeri**: Recd. 12-9-30 Bostan Terek, 10-8-34 Bostan Terek 7,000-8,000 ft. None met with July 1935. Some approach Regeli Alpherakyi, Huebneri, ground light yellow.

* **S. (Karanasa) huebneri**: 6-9-28 Tekkes.

* **S. (Eumenis) mniszechii (baldiva) ?**: Recd. 12-9-30 Bostan Terek, 10-8-34 Bostan Terek, July 1935 Bostan Terek. Common 6,000-7,500 ft.

19. GENUS: EPINEPHELE.

* **E. narica**: 4-8-34 Bostan Terek; July 1935 Bostan Terek 6,000-7,000 ft.

E. naricina: 16-8-34 Bostan Terek 6,000-7,000 ft.

E. hilaris: But deeper red. 11-8-34 Bostan Terek. Only found in one place 9,000 ft. Not seen July 1935.

E. pulchella: 11-8-34 Bostan Terek.

20. GENUS: COENONYMPHA.

* **C. pamphilus**: 6-9-28 Tekkes.

* **C. sunbecca**: Recd. 22-10-30 Bostan Terek, July 1935 Bostan Terek only! Specimen seen and caught.

6. Family: NYMPHALIDÆ.

Subfamily: *Vanessinæ.*

Tribe. VANESSIDI.

7. GENUS: PYRAMEIS.

* **P. cardui (japonica ?)**: 5-9-28 Khan Yailak 8,500 ft.; 7-9-28 Karajon 7,950 ft.; 23-10-33 Bostan Terek, Kasha Ka Su; 10-7-34 Kashgar; 6-8-34 Bostan Terek 6,000-7,000 ft.; 11-10-35 Kurla. Common in plains June to end of October (11-11-73 Karghalik, also at Sanju and south of Sanju).

8. GENUS: VANESSA.

* **V. urticoe rizana**: 13-9-28 Karajon 7,950 ft.; 5-9-28 Khan Yailak 8,500 ft.; August 1934 Bostan Terek; July 1935 Bostan Terek. Not numerous. Caterpillars found (U. Ladakensis 11-10-73, Karatagh Lake on snow mid-day temperature 33°).

* **V. antiopa yadanula**: 5-9-28 Shotta 5,700 ft.; May and June 1929 Tekkes.

9. GENUS: POLYGONIA.

P. egea interposita ?: 20-10-35 Urumchi 3,000-4,500 ft. Common end October and early November, in Pheasant covers around Urumchi. Not caught, identification uncertain.

Tribe: ARGYNNIDI.

12. GENUS: MELITAEA.

* **M. saxatilis**: Recd. 12-9-30 Bostan Terek.

* **M. didyma ala**; May and June 1929 Tekkes.

14. GENUS: ARGYNNIS.

* **A. hegemone**: 5-9-28 Khan Yailak; May and June 1929 Tekkes. Recd. 12-9-30 Bostan Terek, August 1934 Bostan Terek, July 1935 Bostan Terek.

* **A. pales : (isis or korla ?)** May and June 1929. Recd. 12-9-30 Bostan Terek, 11-8-34 Bostan Terek, 20-7-35 Bostan Terek 10,000-12,000 ft. Fairly common.

* **A. lathonia isæa** : 5-9-28 Khan Yailak 8,500 ft.; 8-9-28 Agiass; May and June 1929 Tekkes.

* **A. aglaia** : July 1935 Bostan Terek.

* **A. niobe** : May and June 1929 Tekkes.

* **A. adippe tianchanica** : 5-9-28 Khan Yailak; 10-8-29 Kaying Bashi 10.200 ft.; 12-9-30 Bostan Terek; 15-8-34 Bostan Terek; 20-7-35 Bostan Terek. Common 8,000-10,000 ft.

Argynnis sp.: Size and appearance of *sakontala.* Only 2 seen, chased for an hour on thistles in stony nullah 6,500 ft. August 1934.

7. Family: ERYCINIDÆ.

4. GENUS: POLYCAENA.

* **P. famerlana** : 16-7-35 Bostan Terek 9,000-13,000 ft. Not very common.

8. Family: LYCÆNIDÆ.

22. GENUS: CHRYSOPHANUS.

* **C. solskyi (fulminans ?)** : 12-9-30 Bostan Terek; 5-8-34 Bostan Terek; 19-7-35 Bostan Terek. Common 6,000-7,000 ft.

* **C. phœnicurus (margelanica ?)** : Recd. 12-9-30 Bostan Terek, 16-8-34 Bostan Terek, 19-7-35 Bostan Terek 6,000-7,000 ft.

34. GENUS: LYCAENA.

* **L. cleobis** : May and June 1929 Tekkes 5,400 ft.

* **L. cristophi** : July 1935 Bostan Terek 7,000 ft.

* **L. galathea** : May and June Tekkes.

* **L. (Polyommatus) orbitulus** : 15-8-34 Bostan Terek; July 1935 Bostan Terek 9,000-10,000 ft. Markings heavier than *astorica,* strongly marked spot within cell.

* **L. pheretiades** : Recd. 22-10-30 Bostan Terek; 15-8-34 Bostan Terek; 20-7-35 Bostan Terek 9,000-11,000 ft.

* **L. eros** : Recd. 12-9-30 Bostan Terek; August 1934 Bostan Terek; July 1935 Bostan Terek 6,500-8,000 ft.

* **L. icarus thetis** : 5-9-28 Khan Yailak; May and June 1929 Tekkes. Recd. 12-9-30 Bostan Terek, 15-8-34 Bostan Terek, 20-7-35 Bostan Terek. A smaller blue than found in the plains resembles *yarkandensis* (23-5-74 Yarkand).

* **L. icarus** : 25-5-34 Kashgar; 30-7-35 Kashgar. Common in the plains May-July. Resembles *kashgarensis* (*Polyommatus kashgarensis* April 1874 Yangi Hissar).

* **L. dveanica** : Recd. 12-9-30 Bostan Terek.

L. damone iphigenides ? : 9-8-34 Bostan Terek 8,000 ft.

GRYPOCERA

1. Family: HESPERIIDÆ.

Subfamily: *Hesperiinæ.*

14. GENUS: HESPERIA.

* **H. (Pyrgus) alpina** : 15-8-34 Bostan Terek; 17-7-35 Bostan Terek 9,000-11,500 ft. Common, smaller than Cashmirensis; colour violet brown rather than grey brown.

* **H. tessellum** : May and June 1929 Tekkes 5,400 ft.

PHALAENAE : MOTHS

4. Family: ARCTIIDÆ (*Lithosiinæ*).

69. GENUS: ARCTIA.

A. rueckbeili : 15-7-35 Bostan Terek 7,500 ft. On fir trees in day-time.

5. Family: LYMANTRIIDÆ.

5. GENUS: ORGYIA.

O. trigotephras prisca : 7-8-34 Bostan Terek 6,500 ft.; 27-6-36 Kashgar.

25. GENUS: EUPROCTIS.

E. karghalica : 8-6-34 Kashgar, very common. 7-7-35 Kashgar (25-9-74 Karghalik).

E. lactea ? : (29-5-74.)

13. Family: SATURNIIDÆ.

10. GENUS: NEORIS.

(N. stoliczkana) (shadulla) : (1870 Shadulla R. B. Shaw.)

16. Family: SPHINGIDÆ.

2. GENUS: HERSE.

H. convolvuli : 7-4-34 Kashgar. Common April-September.

36. GENUS: MACROGLOSSUM.

M. stellatarum : 3-11-33 Kashgar; 5-8-34 Bostan Terek. Common Kashgar garden.

38. GENUS: CELERIO.

C. centralasiæ : 7-5-34 Kashgar; 5-5-34 Kashgar. Common.

C. gallii : 1-6-35 hatched Kashgar from caterpillar, August 1934 ex-Bostan Terek.

C. zygophylli : 23-5-36 Kashgar.

17. Family: NOTODONTIDÆ.

5. GENUS: DICRANURA.

D. przewalskii : 18-5-34 Kashgar; 2-6-35 Kashgar.

33. GENUS: PTILOPHORA.

(P. kashgara : 3-3-74 Yangi Hissar.)

NOCTUIFORMES

1. Family: AGARISTIDÆ.

14. GENUS: ACRONICTA.

(A. karghalika : 29-5-74 Karghalik.)

20. GENUS: EUXOA.

E. fatidica : 23-7-35 Bostan Terek 7,500 ft.

E. segetum : (29-5-74 Karghalik.)

E. oberthuri : 12-6-34 Kashgar.

E. exclamationis serena : 18-5-34 Kashgar; 3-5-35 Kashgar.

E. issykula multicuspis : 11-6-34 Kashgar.

21. GENUS: RHYACIA.

R. squalorum : 10-8-34 Bostan Terek.

R. (Agrotis) dichagyris despecta : 15-6-34 Kashgar; 7-8-34 Bostan Terek 6,500 ft. Specimen from Kashgar is larger and darker.

R. spælotis undulans : 2-6-74 Akmasjid; 5-6-74 Chiklik.

R. defuncta : 6-8-34 Bostan Terek 6,500 ft.

R. degniata defuncta : 2-8-36 Kashgar.

Subfamily: *Hadeninæ.*

1. GENUS: BARATHRA.

B. brassicæ canescens : 18-5-34 Kashgar. (30-5-74 Karghalik.)

6. GENUS: POLIA.

P. furcula : 6-8-34 Bostan Terek 6,500 ft.

P. furca : 16-7-33 Bostan Terek 7,500 ft.

P. mista : 8-6-34 Kashgar.

P spiniaceœ kœchiini : 7-8-34 Bostan Terek 6,500 ft.

21. GENUS: CARDEPIA.

C. irrisor : 18-5-34 Kashgar.

Subfamily: *Cucullianæ.*

4. GENUS: STENOSTIGMA.

S. curva : 15-7-35 Bostan Terek 7,500 ft. Pinkish tinge on grey of forewing.

50. GENUS: BLEPHARIDIA.

B. grumi : 15-8-34 Bostan Terek 6,500 ft.

Subfamily: *Amphipyrinæ.*

3. GENUS: AMPHIPYRA.

A. tragopoginis turcomana : 10-8-34 Bostan Terek 6,500 ft.

71. GENUS: ATHETIS.

A. congesta : 11-8-34 Bostan Terek 6,500 ft.

Subfamily: *Heliothidinæ.*

12. GENUS: HELIOTHIS.

H. dipsacea : 15-7-35 Bostan Terek 7,500 ft. (28-5-74 Posgam, April 1874 Yangsi Hissar).

H. obsoleta : 8-7-36 Kashgar.

H. fusca : 27-6-36 Kashgar.

Subfamily: *Erastriinæ.*

29. GENUS: EUSTROTIA.

(**E. olivana=bankia argentula** : May 1874 Ak Masjid.)

37. GENUS: ERASTRIA.

E. trabealis : (—**sulphuralis**) : 13-6-34 Kashgar. Common (*sulphuralis* Yarkand).

38. GENUS: TARACHE.

T. fructuosa: 17-5-34 Kashgar. (April 1874 Yangi Hissar.)

Subfamily: *Catocalinæ.*

2. GENUS: CATOCALA.

C. puerpera orientalis: 20-6-34 Kashgar; 15-6-35 Kashgar. Common.

C. puerpera pudica: 28-6-34 Kashgar; 5-9-34 Kashgar; 14-8-34 Bostan Terek 6,500 ft. Common Kashgar.

C. remissa indecorata: 20-6-34 Kashgar; 15-6-35 Kashgar.

33. GENUS: CLYTIE.

C. syriaca pallida: 2-6-35 Kashgar.

Subfamily: *Phytometrinæ.*

1. GENUS: CALOPLUSIA.

C. alaica: 21-7-35 Bostan Terek 11,000 ft. Day-time.

3. GENUS: SYNGRAPHA.

S. circumflexa: 12-8-34 Bostan Terek 6,500 ft.

4. GENUS: PHYTOMETRA.

P. confusa (gutta): 8-5-34 Kashgar; 31-8-34 Kashgar. Common.

P. Festuca (festata) 9-7-36 Kashgar.

Subfamily: *Noctuinæ.*

20. GENUS: APOPESTES.

A. spectrum centralasiae: 5-10-35 Maralbashi.

(**A phantasma**: 12-11-73 Yarkand.)

21. GENUS: AUTOPHILA.

A. cataphanes: 7-4-34 Kashgar; 7-8-34 Kashgar; 5-10-35 Maralbashi.

A. cataphanes subligaminosa: 7-8-34 Bostan Terek.

58. GENUS: ALEUCANTIS.

A. catocalis: 15-7-35 Bostan Terek 11,000 ft. Day-time.
A. saisani: 7-8-34 Bostan Terek 6,500 ft.
A. caucasica: 27-5-34 Kashgar.
A. hyblaeoides: 15-5-34 Kashgar. (3-6-74 Chiklik.)
A. aksuensis: 8-7-36 Kashgar.

OXICESTA

(**O. marmorea**: 16-5-74 Sasak Taka.)

TAENIOCAMPA

(—**semiophora**) **chiklika**: (6-6-74 Chiklik).

GEOMETRAE

3. Subfamily: HEMITHEINÆ.

28. GENUS: EUCHLORIS.

E. prasinaira: 7-8-34 Bostan Terek 6,500 ft.; 20-7-35 Bostan Terek 7,500 ft.

31. Hemistola.

H. dispartita—Geometra dispartita—Nemoria dispartita : 31-5-74 Bostan Terek.

4. Subfamily: *Acidaliinæ.*

12. Genus: Acidalia.

A. cumulata : 25-7-35 Bostan Terek 7,500 ft.

5. Subfamily: *Larentiinæ.*

47. Genus: Photoscotosia.

P. oberthuri : 15-8-34 Bostan Terek 6,500 ft.

59. Genus: Cidaria.

C. distincta : 18-7-35 Bostan Terek 7,500 ft.

C. (—supethecia) truncata (—caturata) : 3-6-74 Chiklik.

6. Subfamily: *Geometrinæ.*

62. Genus: Ourapteryx.

O. ebuleata : 1-6-35 Kashgar; 20-7-35 Bostan Terek 7,500 ft.

137. Genus: Gnophos.

G. ambiguata : 6-8-34 Bostan Terek 6,500 ft.

G. stolickzaria : (2-6-74 Ak Masjid).

G. tarentidae : 15-7-35 Bostan Terek.

G. thera kashgara : 3-6-74 Chiklik 14,480 ft.

Family: Scoparidæ.

Genus: Eudorea.

E. granitalis : (6-6-74 Chiklik).

E. transversalis : (18-5-74 Igiz Yar 5,600 ft.) (April 1874 Yangi Hissar 4,320 ft.).

PYRALES.

Botydæ.

Botys.

B. flavalis : (April 1874 Yangi Hissar; 2-5-74 Sarikol; 28-5-74 Posgam).

CRAMBICES.

Phycidæ.

Homoeosoma.

H. venosella : (2-6-74 Ak Masjid 8,870 ft.).

Myelois.

M. undulosella : (17-5-34 Aktala 7,342 ft.; 2-6-74 Ak Masjid 8,870 ft.).

M. griseella : (5-6-74 S.-E. of Chiklik).

Tortrices.

Conchylis.

C. stolickzana : (5-6-74 S.-E. Chiklik).

TINEINES.

GELECHIDÆ.

DEPRESSARIA.

D. stigmella : (3-3-74 Yangi Hissar).

RHOPALOCERA : BUTTERFLIES

Srinagar to Border of Sinkiang

1. Family: PAPILIONIDÆ.

8. GENUS: PARNASSIUS.

P. epaphus cashmirensis : 15-9-33 Burzil 15,000 ft.

P. delphius rileyi ? : 15-9-33 Burzil 15,000 ft.

P. charltonius : 15-9-33 Burzil 15,000 ft.

6. GENUS: PIERIS.

P. brassicæ : 20-9-33 Bunji.

P. canidia : 11-9-33 Tragbal.

P. rapæ : 20-9-33 Bunji.

7. GENUS: LEUCOCHLOE.

L. daplidice : 28-9-33 Nomal.

22. GENUS: COLIAS.

C. hyale : 19-9-33 Poshwari.

C. croceus (edusina) : 14-9-33 Burzil Chowki.

3. Family: DANAIDÆ.

1. GENUS: DANAIS.

D. chrysippus : 25-9-33 Gilgit.

D. limniace : 27-9-33 Gilgit.

4. Family: SATYRIDÆ.

15. GENUS: SATYRUS.

S. saraswati : 10-9-33 Tragbal.

S. padma : 10-9-33 Tragbal.

S. anthe enervata : 17-9-33 Astor.

S. telephassa : 19-9-33 Doyan.

S. parisatis : 29-9-33 Chalt.

17. GENUS: PARARGE.

P. maera schakra : 10-9-33 Tragbal.

P. menava : 18-9-33 Dashkan.

19. GENUS: EPINEPHELE.

E. pulchella : 16-9-33 Gudai.

E. pulchella neoza ? : 29-9-33 Chalt.

E. davendra (chitralica) : 29-9-33 Chalt.

6. Family: NYMPHALIDÆ.

7. GENUS: PYRAMEIS.

P. cardui : 29-9-33 Chalt.

8. GENUS: VANESSA.

V. urticae : 10-9-33 Tragbal.
V. cashmirensis : 11-9-33 Tragbal.
V. xanthomelas : 11-9-33 Tragbal. 16-9-33 Gudai.

9. GENUS: POLYGONIA.

P. egea interposita : 11-9-33 Tragbal. 29-9-33 Chalt.

Family: ARGYNNIDÆ.

14. GENUS: ARGYNNIS.

A. pales sipora : 15-9-33 Burzil.
A. adippe jainadeva : 15-9-33 Burzil.

8. Family: LYCÆNIDÆ.

18. GENUS: ILERDA.

I. sena: 29-9-33 Chalt

22. GENUS: CHRYSOPHANUS.

C. phleas : 13-9-33 Gurais.
C. kasyapa : 14-9-33 Burzil Chowki.

26. GENUS: POLYOMMATUS.

P. bœticus : 12-9-33 Poshwari.

31. GENUS: ZIZERA.

(Z. maha) : 28-9-33 Nomal.
(Sizera ?) : 20-9-33 Bunji.

34. GENUS: LYCAENA.

L. galathea (chitralica) : 10-9-33 Tragbal.
L. orbitulus (astorica) : 10-9-33 Tragbal.
L. omphisa : 10-9-33 Tragbal. 13-9-33 Tragbal.
L. stolickzana : 15-9-33 Burzil.
L. icarus : 10-9-33 Tragbal.
L. sarta ; 15-9-33 Burzil.

35. GENUS: CYANIRIS.

C. argiolus coelestina : 10-9-33 Tragbal.

46. GENUS: CHAETOPROCTA.

C. odata : 12-9-33 Poshwari.

GRYPOCERA

1. Family: HESPERIDÆ.

SUB-FAMILY: HESPERIINÆ.

13. GENUS: CARCHARODUS.

C. alceae: 13-9-33 Kagarbal.

14. GENUS: HESPERIA.

H. cashmirensis: 15-9-33 Burzil.

39. GENUS: PARNARA.

P. mathias: 23-9-33 Gilgit.

PHALAENAE : MOTHS

4. Family: ARCTIIDÆ.

3. SUB-FAMILY: HYPSINÆ.

33. GENUS: UTETHEISA.

U. pulchella: 21-9-33 Safed Parri.

SUB-FAMILY: CALLIMORPHINÆ.

71. GENUS: CALLIMORPHA.

C. principalis: 16-9-33 Gudai.

13. Family: SATURNIDÆ.

10. GENUS: NEORIS.

N. stoiickzana: 14-9-33 Burzil Chowki. Marking of *stolickzana*. Colour like *huttoni*.

Family: NOCTUIFORMES.

SUB-FAMILY: AMPHIPYRINÆ.

3. GENUS: AMPHIPYRA.

A. tragopoginis nigrescens 12-9-33 Poshwari.

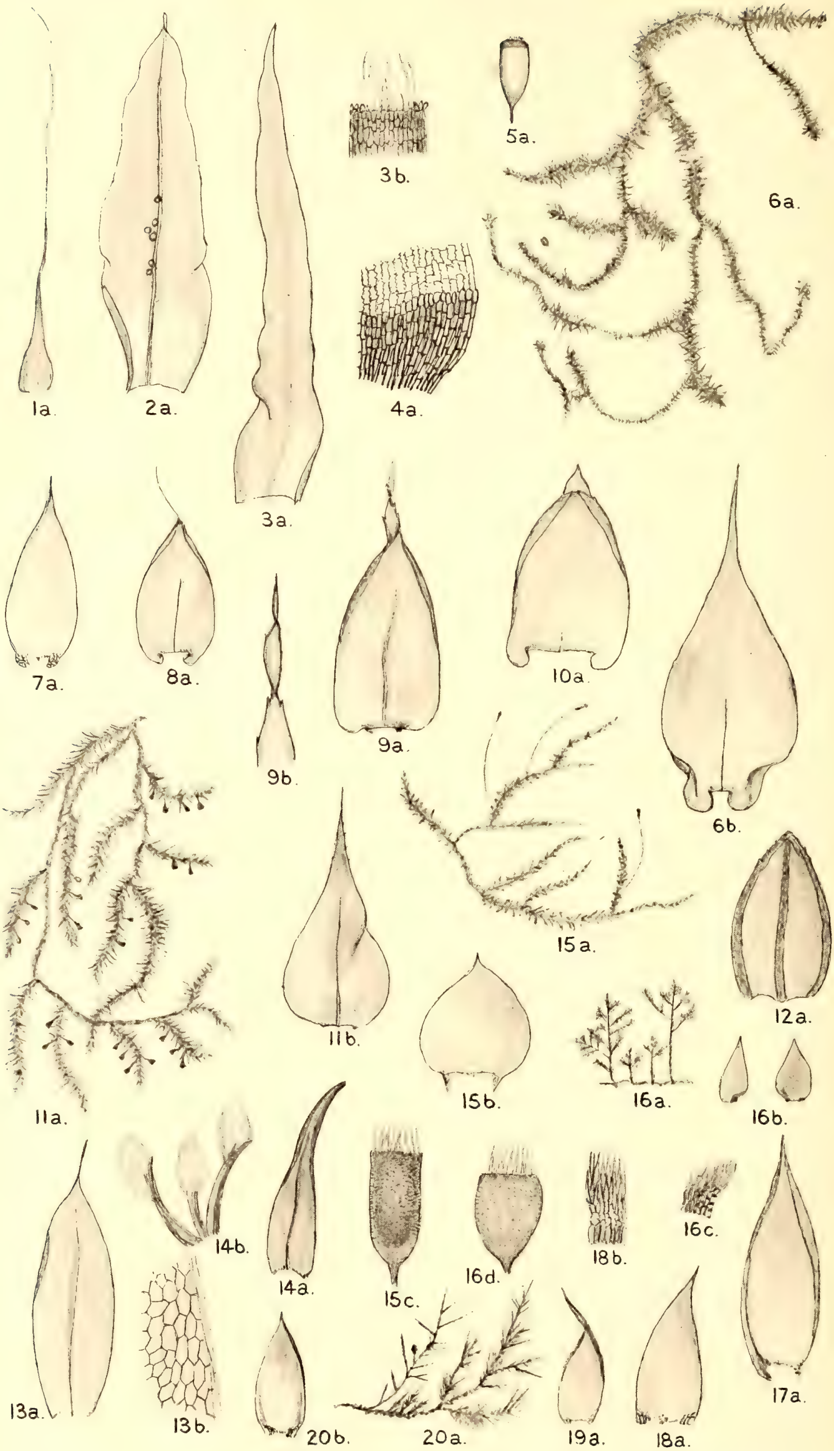
Family: GEOMETRÆ.

5. SUB-FAMILY: LARENTIINÆ.

47. GENUS: PHOTOSCOTOSIA.

Ph. miniosata: 14-9-33 Gurais.

Ph. amplicata: 14-9-33 Gurais.


1a.
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15a.
15b.
15c.
16a.
16b.
16c.
16d.
17a.
18a.
18b.
19a.
20a.
20b.

H. N. Dixon del.
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ASSAM MOSSES.

MOSSES COLLECTED IN ASSAM.

BY

H. N. DIXON, M.A., F.L.S.

(*With a plate*).

The following contribution to the bryology of Assam is based on collections made by Dr. N. L. Bor between 1933 and 1936.

Our main knowledge of the mosses of Assam is derived from the collections made by Griffith, published by himself and more completely worked out by Mitten in the *Musci Indiae orientalis.* In 1914 I published a 'Report on the Mosses of the Abor Expedition, 1911-12', in *Records of the Bot. Survey of India,* vi, pp. 57-73. With the exception of one or two scattered references to individual plants in literature this appears to exhaust our sources of information as to the bryology of this region. The present addition is therefore exceptionally welcome, the more so because the Assam flora is a specially interesting one, phytogeographically, and because the collections indicate a rich bryological flora—over 40 species new to science are included, and one new genus in addition to *Dendrocyathophorum* already described. Such genera as *Orthomniopsis, Jaegerinopsis, Lindigia, Handeliobryum, Hageniella, Leiodontium,* need only to be mentioned to indicate the exceptional interest of the collections.

The types of the new species are in my herbarium.

The topographical notes that follow have been kindly contributed by Dr. Bor.

The area in which a large part of these mosses were collected is known as the Balipara Frontier Tract: bounded on the south by the district of Darrang in Assam, to the north by Tibet, to the west by Bhutan, and to the east by the Sadiya Frontier Tract. The geographical limits are 94° 15″ and 92° 15″ East longitude, and 26° 45″ and 28° North latitude.

The area in the plains at the foot of the hills is directly administered by a Political Officer stationed at Charduar. The hills, however, are under the loose political control of the same officer who tours among the numerous tribes during the cold weather only, as the presence of numerous streams and rivers prevents access during the rains. The area is divided into two sections by the Bhorelli river which issues from the hills and flows into the Brahmaputra.

The area is of exceptional interest in that it has not, up to the present time, been explored botanically and it was not unexpected that many new plants would be found. During the writer's tenure of the post of Political Officer large collections of phanerogams have been made with the object of compiling a flora of the Aka Hills. That work will be produced by the *Botanical Survey of India* by the writer in collaboration with

Mr. K. C. Biswas, M.A., at present curator of the herbarium in the Royal Botanic Gardens, Calcutta.

The hills are a jumbled mass of mountains, the general trend of the ridges being east and west, but there are numerous spurs, roughly north and south, from the main ridges.

The Aka Hills lie just to the west of the Bhorelli and are distinguished by a mountain, Piri, which reaches an altitude of 10,727 ft. To the east of the Bhorelli lie the Dafla Hills, the greatest elevation being 7,000 ft. The slopes are very steep and unstable and are prone to fall away in large slips.

Naturally little is known of the rainfall in the hills as the nearest rain gauge is 20 miles away in the plains. This gauge is at Charduar and records an average rainfall of 100 ins. To arrive at some idea of the rainfall in the hills four stations were selected on the Piri mountain. At each of these places kerosene tins each containing a film of oil were placed in May in trees out of the reach of elephants, and the contents were measured at the end of the rains.

The four stations selected were Doimara, 1,000 ft., Pestiferous Camp, 4,200 ft., Piri La, 9,500 ft. and Rupgya, 5,000 ft. The rainfall recorded from May to October was

Doimara	198 in.
Pestiferous Camp	210 in.
Piri La	246 in.
Rupgya	43 in.

Nothing was done in the Dafla Hills.

It will thus be seen that the southern face of the Piri mountain gets a much larger rainfall than that recorded elsewhere in the plains of Darrang and what is more, that the mountain practically gets all the rain there is. Rupgya is situated to the north of the Piri and gets a very small rainfall. The above figures, it will be observed, are only for a portion of the year and do not include the precipitation, known as the *chota bursat* which is often considerable, which falls in December and January. This precipitation takes the form of snow on Piri and in the valley beyond.

Frost is unknown in the plains but during the winter months the ground is frozen hard on Piri and snow lies on the northern slopes.

In April the weather is usually very dry and desiccating winds dry up the vegetation to the north of Piri and jungle fires are common. In the Dafla Hills which are clothed with evergreen forest and on the south side of Piri the undergrowth never dries up and jungle fires do not take place.

The monsoon approaching from the S.W. strikes Piri and deposits most of the rain on the southern face; only a small amount passes over into the Tenga valley.

Further to the east the monsoon sweeps up the Bhorelli gorge and over the Dafla Hills. The rainfall is everywhere high in this area and evergreen forest is predominant.

The geology of the ranges is interesting. The outer ranges are formed of the Lipam sandstones which explains at once their steepness and their tendency to slip. On the higher ranges Himalayan schist and granite are found and in the Tenga Valley limestone is common.

The vegetation in the Dafla Hills and on the southern face of the Piri is similar so far as equal altitudes are compared. Piri, of course, is much loftier and exhibits a distinctive vegetation of its own between 7,000 ft. and 10,000 ft.

With such a high rainfall and the continual mist on the hills it is to be expected that epiphytes such as lichens, mosses, orchids and the like flourish. The trees on the higher ranges are practically clothed with mosses and lichen, exceptions being those trees which shed their bark, such as the rhododendrons and conifers.

The shady valleys of the lower hills with their sandstone cliffs are favourite habitats of mosses. On the Piri at 10,727 ft. the soil is waterlogged for a considerable portion of the year and is covered with mosses, conspicuous among them being Sphagnum.

To give a detailed description of the flora of these hills would be out of place here: suffice it to say that the southern side of Piri is clothed with evergreen forest, the number of species decreasing as higher altitudes are reached. Oaks and maples make their appearance at 6,000 ft. and pass on upwards into rhododendron, hemlock and silver fir. The Tenga Valley with its low rainfall has a distinctive vegetation of its own. Oak and pine (*P. excelsa*) are predominant with poplar in the valleys. Cypress is confined to limestone.

THE NAGA HILLS.

The Naga Hills district of Assam lies between the parallels 25° 2′ and 26° 47′ north latitude and 93° 17′ and 94° 52′ east longitude. To the north it is bounded by the district of Selsagar; on the south by the native state of Manipur; on the west by the north Cachar Hills, Nowgong and Selsagar, and to the east by a tract of mountainous country between Assam and Burma which is, for the most part, unexplored.

The district consists of a strip of country, the long axis of which runs N.E. and S.W. about 140 miles long and varying in width from 10-32 miles. Apart from a narrow border of plains on the N.W. the whole district consists of a series of ridges, roughly parallel to the long axis, of an average height of 5,000 ft. The main mountainous mass, however, is much higher and consists of two lofty ridges, averaging 8,000 ft., which join just south of Kohima (4,700 ft.), the headquarters of the district. The highest point is Japwo which is 9,898 ft. high. From Japwo the terrain falls steeply, almost vertical in places, but it is connected to the north with Pulebudza (7,000 ft.) by a ridge of the same average height as the latter. From Pulebudza the ridge falls steeply by Kohima.

In the Naga Hills all the slopes of the hills below 5,000 ft. are cultivated. The main ridge, therefore, has not been touched and is wooded to the summit, wherever the slopes are not too steep to carry forest. As is usual in hill forest the vegetation is zoned. From 5,000 ft. to 8,000 ft. the main species are oaks, birch, sycamores and species of Magnoliaceae forming a high forest of about 80 ft. Above 8,000 ft. rhododendrons and birch are the commonest trees. The canopy is rather open and the trees hardly reach 30 ft. Large stretches of Arundinaria are also common about 9,500 ft.

The rainfall at Kohima (4,700 ft.) reaches 70 in., the great bulk of which falls between the months of May and September. No data are available, or the amount of precipitation on the high ridges, but there is no doubt that it is far higher than that of Kohima. The high peaks of the main ridges are smothered in mist during the rains and very frequently during the cold weather. Frost is usual on Japwo during the cold weather, but snow is of comparatively rare occurrence. During the months of March and April, the climate is dry and fires have been known to occur on Japwo. These fires run through the mossy covering of the sandstone of which the ridges are composed. When the moss is burnt off the bare rock is exposed and the trees die, suggesting it is the mossy covering that conserves the water and enables them to exist.

At the higher elevations mosses and lichens are very conspicuous and long streamers of them hang from the branches and clothe the stems of the trees.

SPHAGNACEÆ.

Sphagnum acutifolioides Warnst.—In forest, above 3,000 m. alt., Piri, Aka Hills; October 1933 (9). In abundant fruit. Pseudopodia rather unusually long, generally a little above 1 cm.

FISSIDENTACEÆ.

Fissidens semperfalcatus Dix. (*Journ. Siam Soc., Nat. Hist. Suppl.*, x, 2). Moist soil, 150 m., Dharibati, Aka Hills; November 1934 (208). Elsewhere only known from Siam.

Fissidens rubricaulis Dix. sp. nov.

(Semilimbidium). Humicola. Sat robustus, dense caespitosus, laete viridis, caulibus vetustioribus rubris, 4-5 mm. longis, foliis plurijugis, eis caulium sterilium plumosis. Folia laxiuscula, sicca leniter flexuosa, e basi multo latiore oblongo-lanceolata, late acuta, haud acuminata; lamina vaginans perlata, valde aperta, supra medium folium attingens, limbidio sat bene evoluto, saepe supra laminam versus apicem folii producta. Costa apud basin validiuscula, superne angustata, concolor, infra apicem soluta. Lamina dorsalis ad basin costae vel paullo supra desinens. Margines integerrimi. Cellulae superiores perdistinctae, pellucidae, laevissimae, minutate, circa 6-7″ latae sat regulariter hexagonae, parietibus tenuibus. Folia caulis sterilis breviora, limbidio multo debiliore.

Dioicus. Seta 5-6 mm. Theca erecta, e collo distincto elliptica, sicca suburceolata; operculum rubrum, curvirostellatum; peristomium pallide rubrum, dentium crura spiraliter incrassata et papillosa. Spori saepe ovales, magna, 35-55 μ, laevissimi.

Hab. Balipara Frontier Tract, 100-300 m., November-December 1933 (55), type. Ibidem (58).

A very marked species, distinct among the Semilimbidia in the habit, the pellucid, smooth, minute cells, entire margin and large spores. The stems in the young state are pale, but when old become red, and are then from the lax arrangement of the leaves very conspicuous, recalling the African *F. purpureo-caulis* C.M.

Fissidens bryoides Hedw.—Piri, Aka Hills, 2,700 m.; November 1934 (253). Seta terminal, 1 cm., hence not *F. longisetus* Griff.

Fissidens leptopelma Dix. sp. nov.

(Crispidium). Conferte gregarius, humicola, viridis. Caulis flabellatus, circa 5 mm. longus aeque ac latus. Folia 5-6 juga, madida complanata, sicca rigide falcato-decurva, circa 3 mm. longa, linearilanceolata, e medio folio angustata, peranguste acuminata, acuta. Lamina vaginans minusquam dimidiam partem folii aequans, ad marginem folii oblique desinens; lamina dorsalis ad basin folii sensim decrescens; omnes elimbatae, marginibus minutissime regulariter crenulatis. Costa sat angusta, pallida, concolor, summo apice soluta. Cellulae superiores minutae, hexagonae, dense alte unipapillosae; inferiores laxiores, pellucidae.

Dioicus. Flos ♂ terminalis, conspicuus. Seta terminalis, circa 1 cm., pallida, pertenuis (superne 50-60 μ lata), apice curvato, unde theca cernua vel horizontalis, perminuta, deoperculata circa .75 mm. longa; peristomii dentes longi, crura flexuosa, dense trabeculata, trabeculis intus alte lamellatis. Operculum haud visum.

Hab. Balipara Frontier Tract, 100-300 m.; November-December 1933 (42).

Quite distinct from any of its allies in the long and narrow, very longly and narrowly pointed leaves, as well as in the very attenuated seta.

Fissidens nobilis Griff.—On rock in deep shade, Balipara Frontier Tract 300 m., November 1934 (215). A form with the leaf point more acute than usual, less toothed, sometimes subentire.

Fissidens anomalus Mont.—Piri, Aka Hills, 2,500 m.; November 1934 (258b, 262b). c. fr.

Fissidens areolatus Griff.—Piri, Aka Hills; November 1934 (239, 240) c. fr. I have it also from Shillong, coll. Mrs. Stokoe, November 1912.

GRIMMIACEÆ.

Rhacomitrium javanicum Doz. & Molk.—Japwo, Naga Hills, 3,000 m., October, December 1935 (299, 341). c. fr.

DICRANACEÆ.

Trematodon assamicus Broth.—Charduar; 1934 (76). A fine plant with setae 3-4 cm. long, which agrees well with the description of Brotherus' species.

Garckea phascoides (Hook.) C.M.—Balipara Frontier Tract, circa 200 m.; November-December 1934 (64).

Ditrichum homomallum (Hedw.) Hampe.—Piri, Aka Hills, 2,300 m.; November 1934 (257). As far as I am aware, this species has not been recorded from Asia hitherto.

Ceratodon purpureus Hedw. var. **stenocarpus** (Bry. eur.)—Japwo, Naga Hills, 2,400 m.; October 1935 (316).

Microdus brasiliensis (Duby) Thér.—Shillong, 1,500 m.; September 1934 (168, 192).

Microdus assamicus Dix. sp. nov.

Humilis, caespitosus, soc. cum *Dicranella heteromalla* crescens; caules pauca mm. alti, foliis ad apicem agglomeratis, falcatis, e basi brevissima dilatata setaceis, 2.5-3 mm. longis, integerrimis nisi ad summum apicem saepe 2-3-denticulatis; costa tenuis, lata, male definita, subulam implens. Cellulae basilares laxisimae, hyalinae, late rectangulares, parietibus tenuissimis; supra basin raptim angustatae, angustissime lineares, a cellulis costae aegre distinguendae.

Seta tenuissima, pallidissima, valde flexuosa, saepe fere cygenea; theca minuta, pallida, deoperculata vix 1 mm. longa, ovalis, leptodermica, laevis; exothecii cellulae irregulares, fortiter incrassatae, parietibus valve curvatis; ad orificium rubrae. Peristomii dentes pallide rubri, e basi latiore saepe perforata aut integri aut plerumque in crura duo saepius inaequalia filiformia fissi, sat breves, haud striolati, apud basin tantum leniter trabeculati, supra integri, haud nodosi, laeves. Operculum haud visum.

Hab. Pankim La, Abor Hills, 300-2,900 m., 1934 (145).

The position of this little moss is somewhat indeterminate; the peristome teeth are usually divided, as in Dicranella, but are small, irregular, and smooth, not striolate, as in Microdus, while the very flexuose, sometimes almost cygneous seta suggests an approach to Microcampylopus.

Dicranella heteromalla (Hedw.) Schimp.—In forest, 2,900-3-300 m., Piri, Aka Hills; October 1933 (24, 33). A rather marked form, which may be worthy of a varietal name. The leaves are very strongly serrulate, with short cells almost to the base; the base itself is short, and the basal cells short and wide. The fruit seems normal.

Dicranella divaricata (Mitt.) Jaeg.—Shillong, 1,500 m.; September 1934 (192 p. p.).

Dicranella leptoneura Dix. sp. nov.

Humilis; laxe caespitosa, lutescens. Caulis pauca mm. altus, sublaxifolius, saepe rufescens; folia divaricata, apicalia subsquarrosa, flexuosa, longiora; caulina circa 3 mm. apicalia circa 5 mm. longa, e basi latiore concava sensim in subulam longam flexuosam integerrimam angustata. Costa ad basin circa quartam latitudinem occupans, pertenuis, saepe vix distinguenda, superne subulam fere omnino implens, sectione 2-3-stratosa, e cellulis subaequalibus instructa. Cellulae omnes lineares, angustae, elongatae, basilares parum latiores. Planta ♂ similis, flore intense fusco, turgido, subgloboso. Planta ♂ et fructus valde juvenilis tantum visa.

Hab. Balipara Frontier Tract, 100-300 m., November-December 1933 (48).

In spite of the absence of mature fruit this may safely be pronounced distinct in view of the narrow, elongate cells throughout the leaf, and the extremely tenuous nerve, sometimes so thin in the basal part as scarcely to be distinguishable. The leaf subula is more attenuated than in *D. divaricata.*

Oreoweisia laxifolia (Hook.) Par.—Forest, 2,900-3,300 m., Piri, Aka Hills; October 1933 (40). Ibidem, 3,050 m., November 1934 (261e).

Symblepharis reinwardtii (Doz. & Molk.) Mitt.—In forest, Piri, Aka Hills; October 1933 (3, 20). Him Parbat, 2,000 m.; March 1934 (84). Pankim La, Abor Hills; 1934 (140). Japwo, Naga Hills, 2,700-3,00 m.; December 1935 (330).

Symblepharis helictophylla Mont.—Naga Hills; 1935 (270).

Dicranum lorifolium Mitt.—Japwo, Naga Hills, 2,750-3,000 m., December 1935 (331). I have several other gatherings from Assam in my herbarium.

Dicranum kashmirense Broth.—Pankim La, Abor Hills, 1934 (144).

Dicranum assamicum Dix. sp. nov.

(Pseudochorisodontium) Robustum. Caespites densi, nitentes; caules ad 8 cm. alti, regulariter foliosi; folia falcata, homomalla, supra argute dentata, eis *D. scoparii* subsimilia, sed tenuiora, vix chlorophyllosa; costa multo tenuiore, cellulis minoribus, pellucidis, parietibus ubique valde porosis.

Perichaetia cylindrica, bracteis internis convolutis, apice rotundato, abrupte cuspidato vel breviter aristato. Seta circa 2 cm. alta. Theca majuscula, erecta, symmetrica, aequalis, fusca, cylindrico-fusiformis, laevis. Opereum; paullo brevius, rectum. Peristomium magnum, bene evolutum, purpureum; dentes pallo irregulares, laeves, subpellucidi, fortiter lamellati. Spori variabiles, usque ad μ. 35

Hab. Japwo, Naga Hills, 2,750-3,000 m.; 7 December 1935 (333).

D. himalayanum Mitt. has the leaves entire, the peristome papillose; the teeth here are almost entirely smooth (I have seen faint traces of vertical striolation in the upper part of one or two).

Brothera leana (Sull.) C.M.—Shillong, 1,830 m.; September 1934 (184 p.p.). With dense apical tufts of small brownish brood-bodies.

Brothera capillifolia Dix. sp nov. (Plate I, fig. 1).

Multo laxiore et elatiore quam *B. Leana;* caules 2 cm. alti, laxiuscule, saepe interrupte foliosi; inferne radiculis albidis intertexti. Folia sericea, patentia, falcata, valde decidua, e basi perbrevi, perpellucida, convoluto-concava, dimorpha; aut subsensim in subulam setaceam plusminusve argute conferte denticulatam, aut abrupte in subulam longissimam (duplo fere longam) tenuissimam, capillaceam, integram vel subintegram angustata. Cellulae basilares laxissimae, magnae, parietibus tenuibus, ad margines multo angustiores, supra perangustae, parvae, pellucidae, elongatae. Costa ad basin perlata, spongiosa, e stratis 3-4 cellularum inanium, pellucidarum, magnarum, parietibus pertenuibus instructa, superne angustata, male definita, e cellulis angustissimis composita.

Hab. In forest, 2,900-3,000 m., Piri, Aka Hills; October 1933 (5).

Possibly the type of a new genus, but sufficiently near *B. Leana* in the nerve structure, particularly in the lower part of the leaf, to be placed there, at least temporarily. The foliation is peculiar, the normal cauline leaves appear to be comparatively short, setaceous, but not very longly so (3-4 mm.), chlorophyllose, and frequently closely denticulate to near the base; at certain points on the stem the leaves, densely crowded, are entirely different, less or not chlorophyllose, deciduous, entire, very rapidly narrowed from the base to a much longer, much finer, entire, capillary subula; these may attain to even 1 cm. in length. The leaf base is minute, spongy, so concave as to appear when detached almost solid and bulbiform, pale, slightly reddened at the line of insertion.

Campylopus lætus (Mitt.) Jaeg.—Shillong, 1,800 m., September 1934 (191).

Dicranodontium dimorphum Mitt.—Piri, Aka Hills, 3,000 m.; November 1934 (261d). Naga Hills; 1935 (274). Japwo, Naga Hills; 2,750-3,000 m., December 1935 (342) c. fr.

Several of the Indian species described by Mitten are difficult to separate from one another, the fruit even when present does not always give much assistance. No. 261 has the subula more toothed than usual, but in other respects seems to agree. No. 274 is a rather marked plant, having conspicuous purple auricles, and a strong nerve; it is a much more robust plant than *D. didymodon* (Mitt.) and *D. caespitosum* (Mitt.). An unpublished Himalayan species of Brotherus has equally conspicuous auricles, but has a flat subula and very much narrower nerve. No. 342 is in fruit in nice condition; I believe the fruit has not been recorded. The seta is about 1 cm. high, very thin, pale, when dry erect and flexuose, the capsule small, dark, erect, elliptic from a tapering base, symmetric, smooth, the lid straight, rather shorter than the capsule.

Dicranodontium asperulum (Mitt.) Broth.—Naga Hills; 1935 (269). A form with remarkably white leaf bases, as well as white tomentum.

Dicranodontium decipiens (Mitt.)—Cheswezuma, Naga Hills, 2,100 m.; December 1935 (324). A difficult plant. It appears to belong to Dicranodontium. Reimers issued it in Max Fleischer, M. Fr. Archip. Ind. et Polyn., No. 561, as 'Dicranodontium decipiens (Mitt.) Mitt.', but I have been unable to trace the publication where Mitten placed it under the present genus.

LEUCOBRYACEÆ.

Leucobryum javense (Brid.) Mitt.—Kanjara, Naga Hills, 2,000 m.; November 1935 (363).

Leucobryum bowringii Mitt. var. sericeum (Broth.) Dix.—Pestiferous Camp, 1,200 m., Piri, Aka Hills; November 1934 (227). The nerve is almost homostrosic, only a single cell here and there, both dorsal and ventral, being transversely divided, very near the base of the leaf.

Leucophanes octoblepharoides Brid.—Balipara Frontier Tract; November-December 1933 (63).

Octoblepharum albidum Hedw.—Near Charduar: 1934 (154).

Exodictyoa blumii (C.M.) Fleisch.—Forest, 3,000-3,300 m., Piri, Aka Hills; October 1933 (21b). New to Northern India. Distr. Java; Philippines; Borneo; Malay Penins.

CALYMPERACEÆ.

Syrrhopodon pilulifer Dix. sp. nov. (Pl. I, fig. 2).

Thyridium. Corticola. Subrobustus, saturate olivaceo-viridis, ramis circa 3 mm. longis; folia sicca leniter rigide incurvo-hamata, 2.5-3 mm. longa, e

basi brevi erecta vix latiore late oblongo-lanceolata, breviter acutata, latiuscule cuspidata, marginibus vix undulatis, integris vel subintegris; costa validiuscula, stricta, dorso laevis. Limbus cartilagineus inferne latus, usque ad 20-seriatus, sat longe infra apicem solutus. Cellulae perminutae, parietibus tenuibus, laevissimae. Cancellina brevis. lata, e cellulis parvis composita. Corpuscula parva, numerosa (circa 30-40 μ lata), sphaerica, pluricellularia, fusca, in pagina et costae ventri inveniuntur.

Seta circa 5 mm., theca minuta, erecta, vix nitida.

Hab. Balipara Frontier Tract, 100-300 m.; November-December 1933 (46).

The much broader, entire border, smooth cells, and absence of secund-leaved stoloniferous branches separate this from *S. flavus* and *S. Vriesei,* and (except for the last character) from *S. cuspidatus.*

The minute spherical bodies on the upper surface of the leaf appear to be of the nature of gemmae; if algoid there would be no reason for their being confined to this region of the leaf. Apical tufts of small, fusiform gemmae are also present at the tip of most leaves.

Calymperes burmense Hampe.—In forest, 3,000-3,300 m., Piri, Aka Hills; October 1933 (2). This agrees well with Hampe's type. It appears to be a rare species, only found hitherto in Burma.

Calymperes hampei Doz. & Molk.—Charduar; August 1934 (173).

POTTIACEÆ.

Trichostomum cylindricum Bruch—Pulebudze, 2,350 m., Naga Hills; August 1935 (294a). Japwo, circa 2,750 m., Naga Hills; December 1935 (330 p.p.). Both c. fr.

Pseudosymblepharis pallidens Dix. sp. nov. (Pl. I, fig. 3).

Gracilescens, elata, habitu *Symblepharidis helictophyllae* Mont. Folia laxiuscula, patentia, superne comosa; sicca crispata, 3-4 mm. longa, e basi erecta, subvaginante, sensim angustata, lineari-lanceolata, sensim anguste acuminata, acuta, marginibus planis, intergris seu crenulato-papillosis. Costa ad basin sat valida, superne attenuata, pellucida, infra apicem soluta. Cellulae superiores subquadratae, vel subrotundatae, distinctae, parietibus firmis, subincrassatis, papillosae, basilares longiores, breviter rectangulares, infimae paucae laxiores, pellucidae, parietibus tenuioribus.

Dioica. Folia perichaetialia caulins subsimilia.—Seta 1 cm., tenuis, erecta, pallida. Theca parva, cum operculo 3.5 mm. longa, anguste elliptica, paullo asymmetrica, operculum pallide tenuirostre, thecae longitudinem fere aequans, cellulis laxiusculis, seriebus rectis, haud obliquis. Annulus latus, persistens, sed facile dilabilis. Exothecii cellulae elongate rectangulari-hexagonae, parietibus tenuissimis. Spori parvi. Peristomium perpallidum, dentes ad basin cohaerentes, inde in crura divisa valde irregularia et inaequalia, saepe anastomosantia, vel ramificantia, vix nodosa, dense humiliter papillosa.

Hab. Japwo, Naga Hills, 2,450 m.; October 1935 (322).

The leaves are shorter and wider than in most of the species. They are very similar to those of *P. pervaginata* (Broth.) Broth., but much less dilated below.

Hyophila involuta (Hook.) Jaeg.—Several gatherings.

Barbula gregaria (Mitt.) Jaeg.—In forest, Piri, Aka Hills, 3,000-3,300 m.; October 1933 (11).

Barbula indica Brid.—One or two gatherings, on the lower ground.

ORTHOTRICHACEÆ.

Ptychomitrium rhacomitrioides Dix. sp. nov. (Pl. I, fig. 4).

Robustum, caespitosum; caules ad 8 cm. alti, erecti vel adscendentes, parce ramosi, interrupte foliosi, olivacei. Folia patenti-squarrosa, sicca fortiter crispata, magna, 5-6 mm. longa, e basi longa, lata, vaginante, plicata, subsensim in laminam recurvam, latam, canaliculatam, fortiter regulariter runcinatam subabrupte terminatam angustata. Costa inferne valida, supra angustior, cum apice evanida. Margines supra basin angustissime recurvi. Cellulae supremae subisodiametricae, seriatae, incrassatae, perdistinctae, parietibus leniter sinuosis; versus basin sensim elongatae, breviter rectangulares, parietibus valde sinuosis; inde multo longiores, 4-6×1, fortiter sinuosae, omnino Rhacomitrioideae; infimae abrupte mutatae, per totam latitudinem pulchre aurantiacae, laxae, magnae, 2-stratosae, inanes, parietibus rectis, tenuibus.

Autoicum. Fructus terminales, sed saepe ad annum sequentem persistentes, 2-5 aggregati; folia perichaetialia vix distincti; seta circa 8 mm. longa, erecta, pallida, ad basin et vaginluam rubra. Theca leptodermica, in collum defluens, operculata circa 4 mm. longa, cylindrica; operculum rectum, aciculare; calyptra straminea, nitida, basi laciniata leniter plicata. Peristomium generis, dentes aurantiaci, praelongi, crura stricte tenuissime capillaria, praealte, tenuissime papillosa. Spori minuti.

Hab. Japwo, Naga Hills, 2,750-3,000 m., 7 December 1935 (343), type. Ibidem (330). Above Dharmsala, Punjab, India, circa 2,750 m.; 17 June 1929; coll. R. R. Stewart (10309A).

A very striking plant, especially in the remarkable areolation; the cells at insertion are a deep orange, at least 2-stratose; lax, thin-walled and pellucid, forming deep pseudo-auricles resembling those of Dicranum but reaching quite across the leaf; above these all the cells are absolutely Rhacomitrioid, and only in the part of the laminā above the base take on a more normal Ptychomitrioid form, but even then retaining, sometimes to the apex, traces of the sinuosity of the walls. The Himalayan plant was first seen, and I referred it without hesitation to Holomitrium, no calyptra being present, and the peristome being all more or less destroyed (It was this plant to which I referred in *Annales Bryology.*, vi, 21, as having a similar areolation to a new species of Symblepharis from Mt. Cameroon). The Ptychomitrioid calyptra of the Assam plant revealed its true position.

Zygodon brevisetus Wils.—Chingku, Naga Hills, 2,500 m.; November 1935 (354). Very near *Z. intermedius* Bry. eur., but apparently distinct.

Macromitrium nepalense (Hook. & Grev.) Schwaegrichen—Ngorruara, on dead log, 900 m., Naga Hills; November 1935 (349).

Macromitrium calymperoideum Mitt.—Balipara Frontier Tract, below 300 m.; November-December 1933 (49). Common on trees in plains, near Charduar; August 1934 (74, 178).

Macromitrium hamatum Dix. sp. nov.

Belongs to the group of Leiostoma having leaves with broad, strongly inflexed or hamate leaf apices, and smooth basal cells, to which *M. nepalense* and *M. assamicum* belong. It differs from these however in having the leaves not spirally twisted when dry, but strongly incurved and crispate. In this it is nearer to *M. calymperoideum*, which differs slightly but distinctly in the shorter, broader, more obtusely pointed leaves, with the cells short and very little altered to base. *M. inflexifolium* Dix. from Siam has quite different upper cells. The leaves here are longer and more tapering than in any of the allied species, widely but quite acutely pointed.

M. calymperoideo Mitt. affine. Differt foliis longioribus, angustioribus, ad apicem anguistatis, acutis vel apiculatis, cellulis basilaribus pellucidis, infimis, praecipue marginalibus elongatis, linearibus, juxtacostalibus paucis laxis, inanibus. Cellulae superiores minutae, 5-7 μ laeves vel humillime mamillosae. Calyptra pilosa. Fructus immaturus solum visus.

Hab. On tree trunk, 1,680 m., Pedi, Naga Hills; 1 August 1935 (284 bis).

Macromitrium rigbyanum Dix. sp. nov. (Pl. I, fig. 5).

Sat robustum. Rami variabiles, plerumque longiusculi, densifolii. Folia sicca valde crispata, angusta, lingulata, sensim anguste acuminata, acuta; costa cum apice soluta vel brevissime excurrens. Cellulae circa 8 μ distinctae, humiliter papillosae, marginales regulariter minute crenulatae, infra sensim elongatae, basilares lineares, angustae, laeves, paucae juxtacostales 'calymperoideae'. Bracteae prichaetii angust acuminatae, stricte breviter aristatae. Seta circa 6 mm. longa. Calyptra pilosa. Operculum aciculare. Theca e collo brevi breviter cylindrica, laevis, fusca, apud orem vix angustata, ibidem purpurea, subnitida, microstoma. Peristomium bene evolutum, e dentibus flavidis dense papillosis in membranam vel per paria plusminusve cohaerentibus instructum. Spori variabiles, magni, usque ad 27 μ

Hab. Kurseong, Himalayas, 1926; coll. Fr. Rigby, comm. Rev. G. Foreau (592), type. Assam, Him. Parbat, 2,000 m., 21 March, 1934; coll. N. L. Bor (89). Ibidem, Peak, Charduar, 1,850 m.; 1934 (167). Pankim La, Abor Hills, 300-2,900 m.; 1934 (148). On rock, Dzulake, Naga Hills, 1,850 m.; 31 August 1934 (280 bis).

A very distinct plant, not in habit or leaf structure, but in the capsule. This is cylindrical or barrel shaped, scarcely tapering to the mouth but with a purplish cushion of much smaller, incrassate exothecial cells surrounding the mouth and extending for an appreciable distance down. It is similar to that of *M. bathydontum,* described by Cardot from Corea.

Maromitrium turgidum Dix.—Japwo, Naga Hills, 2,400 m.; October 1935 (303). Ibidem, 3,000 m.; November 1935 (310).

Nov. var. **laeve** Dix. Cellulae basilares laeves.

Dafla Hills, 1,200 m., March 1934 (90) Tako Senyak, 1,200 m.; March 1934 (113). Paora, Naga Hills, on tree trunk, 2,150 m., September 1935 (283 bis).

In the original plant from Siam the basal cells were more or less markedly tuberculate. As this is usually considered a crucial character, I have thought it best to describe the smooth-celled plant as a variety. The character is however not a constant one, as in one or two of the Assam gatherings I have found the basal cells indiscriminately smooth or tuberculate on the same specimen.

Macromitrium sulcatum Brid.—Japwo, Naga Hills, 2,750-3,000 m.; December 1935 (338).

Macromitrium ramentosum Mitt.—Tako Senyak, Dafla Hills, 1,200 m.; March 1934 (103). Hitherto only known from Ceylon.

FUNARIACEÆ.

Funaria wallichii (Mitt.) Broth.—Shillong; September 1934 (200).

Funaria hygrometrica Hedw. (*F. leptopoda* Griff.)—Several gatherings.

SPLACHNACEÆ.

Splachnobryum assamicum Dix. sp. nov.

S. Oorschotii forsan affine; multo gracilius, laxifolium, foliis siccis valde flexuosis, convolutis. Folia madida patula, 1.5 mm. longa, perconcava, saepe subconvoluta, e basi oblonga latiore sensim lingulata, plerumque rotundato-obtusa, marginibus planis vel recurvis, integerrimis. Costa tenuis, summo apice soluta. Rete perpellucidum, e cellulis parvis, rectangularibus, parietibus tenuissimis instructum. Cellulae superne sensim abbreviatae, irregulares, rhomboideo-hexagonae, ad apicem subisodiametricae.

Dioicum; planta ♂ femineae subsimilis, floribus axillaribus numerosis magnis, turgidis, antheridiis magnis, congestis. Seta circa 6 mm. longa, tenuissima, intense rubra. Theca minuta, 1 mm. longa, subcylindrica; peristomium haud visum.

Hab. On brickwork, Charduar, 2 August 1934 (176), type. On sandy soil, 700 m., Charduar; 13 July 1934 (162).

A strongly marked species in the narrow, lingulate leaves, deeply channelled, with nerve reaching close to the apex.

Tayloria indica Mitt.—Piri Camp, 2,300 m., Aka Hills; November 1934 (265). Naga Hills; 1935 (268, 284).

Tayloria subglabra (Griff.) Mitt.—Pulebudze, Naga Hills, 1,700 m.; 8 August 1935 (291). nov. var. **spinosa.** Folia fortiter, irregulariter dentata, fere laciniata. A form with the leaves much larger and more spreading, and the toothing much coarse than usual in this species, but I think must be considered a variety only. The calyptra agrees. Takuja, Naga Hills, 1,700 m.; November 1935 (346).

BRYACEÆ.

Mielichhoferia assamica Dix. sp. nov.

E robustissimis generis. Caespitosa, viridis. Caulis 5 cm. altus, densifolius. Folia sicca madidaque patentia, sicca leniter contracta, parum mutata, 2-2.25 cm.

longa, versus basin 4 mm. lata, fere e basi ad apicem sensim angustata, acuminata, peracuta; marginibus planis, ubique minutissime denticulatis. Costa tenuiuscula, cum apice evanida. Cellulae pellucidae, angustissimae, minutae, lineares, obtusae, parietibus tenuibus, strictis; basilares parum latiores.

Cetera ignota.

Hab. On sand, Bhorelli river bed, 300 m., Bhalukpung, Aka Hills; 2 November 1934 (211).

The largest species I know. An unpublished Himalayan species, now in the press, *M. Badhwarii* Dix., resembles it in size, but has much wider cells and sharper toothing.

Webera elongata Hedw.—In forest, 2,900-3,300 m.; Piri, Aka Hills, October 1933 (14, 41). Japwo, Naga Hills, 3,000 m.; October 1933 (300).

Webera cruda (Hedw.) Bruch—In forest, 2,900-3,300 m., Piri, Aka Hills; October 1933 (28).

Webera flexuosa (Hook.) Mitt.—In forest, 2,900-3,300 m., Piri, Aka Hills; October 1933 (17).

Webera humicola Dix. & Varde—Lozaphohemi, Naga Hills, 1,220 m.; November 1934 (304). Described in 1927 from the Palni Hills, South India, and not known elsewhere.

Brachymenium exile (Doz. & Molk.) Bry. jav.—Zehwera, Naga Hills, 1,800 m.; August 1935 (281b).

Brachymenium walkeri Broth.—Shillong, 2,000 m.; September 1934 (193). I cannot separate this from the Coorg plant.

Brachymenium nepalense Hook.—Zehwera, Naga Hills, 2,100 m., September 1935 (288).

Anomobryum cymbifolium (Lindb.) Broth.—Shillong, 1,500 m.; September 1934 (188). On rock, 1,700 m. Zehwera, Naga Hills; August 1935 (279 bis). Tree trunk, 1,700 m., Pedi, Naga Hills; September 1935 (285). All c. fr.

Bryum cellulare Hook.—Bhalukpung, Bhorelli river bed, 300 m.; November 1934 (214). Sterile.

Bryum argenteum Hedw.—Several gatherings.

Bryum porphyroneuron C.M.—Shillong, 1,400 m.; July 1934 (164). Fruit immature, but probably belongs here.

Bryum nitens Hook.—Shillong, 1,400 m.; September 1934 (182), c. fr.

Rhodobryum giganteum (Hook.) Par.—Piri, Aka Hills, 2,750 m.; November 1934 (245).

MNIACEÆ.

Mnium heterophyllum (Hook.) Schwaegr.—Pankim La, Abor Hills, 1934 (118).

Mnium lycopodioides (Hook.) Schwaegr.—In forest, 2,900-3,300 m., Piri, Aka Hills; October 1933 (16).

Minium thomsoni Schimp.—Piri, Aka Hills, 3,000 m.; November 1934 (262, 267f). In fine fruiting condition. The capsule has a distinct collum, and is large; the lid is longly rostellate, almost rostrate.

Mnium lævinerve Card.—In forest, 2,700-3,300 m., Piri, Aka Hills; October 1933 (1, 35), c. fr. and ♂ plant.

Mnium rostratum Schrad. var. coriaceum (Griff.) Dix.—Pankim La, Abor Hills; 1934 (129, 136, 142). Shillong, 1,200 m.; September 1934 (201). And other gatherings. Mostly c. fr. This keeps its characters very constantly, and is, I am persuaded, deserving of varietal rank.

Mnium succulentum Mitt.—Piri, Aka Hills, 3,300 m.; November 1934 (267c).

Mnium punctatum Hedw. var. reflexifolium Kabiersch—In forest, 2,700-3,300 m., Piri, Aka Hills; October 1933 (27), c. fr. This seems a well marked variety.

Orthomnion trichomitrium Wils.—Him Parbat, 2,000 m.; March 1934 (87). Tako Senyak, 1,200 m.; March 1934 (106). Both c. fr.

Orthomniopsis japonica Broth.—Pestiferous Camp, 1,375 m.; Piri, Aka Hills; November 1934 (229), c. fr.—An exceedingly interesting discovery. At the time of collecting it was known only from two localities in Japan. Since then, however, it has been found in New Guinea, and also in the Philippines.

RHIZOGONIACEÆ.

Rhizogonium spiniforme (Hedw.) Bruch—In several gatherings.

BARTRAMIACEÆ.

Bartramia halleriana Hedw.—In several localities; Aka Hills, Abor Hills, and Naga Hills.

Bartramia leptodonta Mitt.—Piri, 3,000 m., Aka Hills; November 1934 (267g).

Philonotis gammieana Broth.—Tree trunk, 1,700 m., Piri, Naga Hills; September 1935 (286).

Philonotis angusta Mitt.—Charduar, 1934 (77). Aka Hills, 300 m.; November-December 1933 (44). Piri, Aka Hills; October 1933 (22). All c. fr.

Philonotis longicollis (Hampe) Mitt.—Naga Hills; 1935 (276) c. fr.

ERPODIACEÆ.

Erpodium mangiferae C.M.—On mango tree, Charduar; July 1934 (163).

HEDWIGIACEÆ.

Cleistostoma ambiguum (Hook.) Brid.—Piri, Aka Hills; November 1934 (230).

CRYPHAEACEÆ.

Pilotrichopsis dentata (Mitt.) Besch.—In forest, 2,700-3,300 m. Piri, Aka Hills; October 1933 (23b). c. fr. A rather lax, slender form; but the species shows considerable variation, and I think it may be safely placed here. New to Assam. Distrib. China, Japan, Philippines.

LEUCODONTACEÆ.

Leucodon secundus (Harv.) Mitt.—Pankim La, Abor Hills; 1934 (151).

TRACHYPODACEÆ.

Diaphanodon blandus (Harv.) Ren. & Card.—Piri, Aka Hills, 3,000 m.; November 1934 (255, 261f). c. fr.

Diaphanodon thuidioides Ren. & Card.—Pankim La, Abor Hills; 1934 (138b). c. fr. Only known from the Central Himalayas and Yünnan, hitherto.

Trachypus bicolor Hornsch. & Reinw.—In several localities, mostly fruiting. One from Piri has the leaves strongly and prettily falcate.

Trachypus pendulus Dix. sp. nov.

Gracilis, atroviridis, habitu Diaphanodontis thuidioidis sed paullo robustior. Caulis pendulus, flexuosus, pinnatim ramosus, ramis circa 1 cm. longis, inaequalibus, caudiformibus. Folia patula, sicca suberecta, plicata, e basi late fortiter auriculata oblongo-lanceolata, leniter asymmetrica, acumine torto, late loriformi, distanter denticulato. Costa tenuis, versus medium folium soluta. Cellulae lineares, pellucidae, tenerrime pluripapillosae, saepe fere laeves, basilares paullo latiores, pellucidiores.

Fructus ignotus.

Hab. Pankim La, Abor Hills, 300-2,745 m.; 1934 (138a).

Mixed with a rather robust form of *Diaphanodon thuidioides*, and not easy at once to separate, but the leaves with twisted apex, and long, pluripapillose cells clearly distinguish it under the microscope. The papillae are very slightly developed, however, for the genus. It also resembles to some extent *Duthiella Wallichii,* but the auriculate base, pellucid cells, and finely denticulate margins are very different.

Trachypodopsis auriculata (Mitt.) Fleisch.—Piri, Aka Hills, 2,700-3,300 m.; October 1933 (26), c. fr.

Trachypodopsis himantophylla (C.M.) Fleisch.—In several distinct localities, mostly at moderately high altitudes, sometimes fruiting. It is quite a marked plant, but I doubt whether it is more than a var. of *T. crispatula.*

PTEROBRYACEÆ.

Jægerinopsis integrifolia Dix. sp. nov. (Pl. I, fig. 6).

Pendula videtur. Caulis flexuosus, 10 cm. vel ultra longus, valde complanatus, parce, distanter ramosus, ramis divaricatis, inaequalibus (perbrevibus vel 1 cm. longis), complanatis, interrupte foliosis. Folia complanata, nunc laxa, nunc conferta, horride squarosa, usque ad 4 mm. longa vel paullo ultra, juniora viridia, seniora fusco-aurantiaca, e basi amplexicauli valde auriculata late ovata, subraptim in subulam strictam loriformem acutissimam integerrimam contracta. Costa brevis, debilis, nonnunquam bina, vel obsoleta. Cellulae angustissimae, lineares, incrassatae, basilares valde incrassatae, parietibus porosis, apud auriculas magnas pulchre aurantiacae.

Fructus unicus visus. Perichaetium longum, bracteis longe convolutis, superne subula abrupte reflexa, stricta, integra, robusta. Seta circa 4 mm., laevis, erecta. Calyptra, operculum, ignota. Peristomium flavidum, dentes lanceolati, hic illic conjuncti, laeves, saepe perforati, marginibus irregularibus; dorsaliter dissepimentis latis, intus sat alte, dense lamellati; fragmenta praeperistomii ad basin visa. Endostomium ut videtur rudimentarium.

Hab. Pankim La, Abor Hills, 300-2,750 m.; 1934 (138c).

The generic position of this plant is not quite certain. In the long, straggling, loosely branched stems, with complanate, very squarrose leaves, it is much like species of Jaegerinopsis, with which the leaf structure and general fruiting characters agree; the peristome is rather different from that characteristic of the genus, the teeth being longer and narrower, not short, broad and obtuse as is the case with the species where fruit is known. The presence of a praeperistome is in favour of Jaegerinopsis, but otherwise the teeth are more like those of Hildebrandtiella as figured by Brotherus.

A rather marked feature of the growth is the interrupted nature of the branches. The leaves may be normally large for some distance, then suddenly much smaller for a space; and sometimes a length of the stem or branch has only very minute, distant, spreading or squarrose leaves.

Endotrichella elegans (Doz. & Molk.) Fleisch. Dafla Hills, 1,375 m.; March 1934 (91), c. fr.

Symphysodontella subulata Broth.—Tako Senyak, 1,400 m.; March 1934 (93b), c. fr. I believe the fruit has not been seen before. Perichaetial bracts erect, convolute, few, acuminate; capsule exserted, seta 3-4 mm., roughish; capsule small, deoperculate scarcely more than 1 mm. long, erect, brown, turgidly elliptic; peristome almost lost, teeth pale, yellow, apparently like those of *S. cylindracea.* Only two old capsules seen. Only known from the Philippines.

Symphysodontella borii Dix. sp. nov. (Pl. I, fig. 7).

Sat robusta. Caulis secundarius indistincte dendroideus, vage pinnatim ramosus, ramis leniter curvatis, cuspidatis, nitidis, interdum subflagellaceis. Folia irregulariter disposita, nunc patentia, nunc erecta, sicca vix mutata, ecostata, 2-2.5 mm. longa e basi angustata ovato-lanceolata, concava, in acumen strictum, subulatum, cutissimum integerrimum angustata. Cellulae angustissimae, conflatae, parietibus tenuissimis, basilares vix mutatae, ad insertionem aurantiacae, alares magnae, numerosae, rotundatae, scalariformes, auriculas magnas, pulchre aurantiacas, decurrentes instruentes. Bracteae perichaetii lanceolato-subulatae, sat longae, erecto-patentes, robuste acuminatae, integrae. Seta 1-2 cm. vel paullo ultra, tenuis, stricta, laevis; theca parva, circa 2 mm. alta, ovalis, erecta, microstoma; exothecii cellulae laxae, hexagonae, parietibus tenuibus, firmis, versus orificium seriebus multis sensim minores. Calyptra cucullata, laevis. Operculum haud visum. Peristomium pallide aurantiacum;

dentes anguste lanceolati, stricti, hic illic cohaerentes, interrupte tenerrime albide marginati, laeves, parum lamellati aut nodosi. Endostomium nullum.

Hab. Tako Senyak, Dafla Hills, 1,400 m.; 19 March 1934 (93), type. Dafla Hills, 1,200 m.; 20 March 1934 (90b).

The habit and the very strikingly auricled leaves are somewhat inconsistent with Symphysodontella, but the fruiting characters and general leaf structure agree well, and there is certainly no other genus in which it can be placed. The distinct alar cells of *S. tortifolia* described below confirm this.

Symphysodontella pilifolia Dix. sp. nov. (Pl. I, fig. 8).

Caulis secundarius subdendroideus, circa 6 cm. altus, supra irregulariter distanter pinnatim ramosus, ramis flexuosis, attenuatis, parce breviter ramulosis; sordide viridis, paullo nitida. Folia stipitis inferiora parva, squamiformia, superiora ut caulina 2-2.5 mm. longa, e basi auriculata late ovalia, cochleariformia, apice subito in pilum longum capillare flexuosum integrum contracta, integra seu ad basin pili minute denticulata; costa bina, irregularis. Cellulae angustissimae, inferne vix mutatae, ad insertionem seribus circa duabus latiores pulchre aurantiacae; alares nullae. Folia ramea similia sed angustiora, sensim piliformia.

Fructus ignotus.

Hab. Pankim La, Abor Hills; 1934 (116b).

Perhaps nearest to *S. involuta*, but quite distinct from all the species in the broad, cochleariform leaves abruptly piliferous. The nerve is sometimes single, with or without a short basal branch, sometimes with two subequal almost parallel branches, reaching to near mid-leaf.

Only a single stem was found.

Symphysodontella tortifolia Dix. sp. nov. (Pl. I, fig. 9).

Robusta. Olivaceo-viridis. Caules secundarii dendroidei, rigidi, circa 8 cm. alti, caule lignoso, infar nudo vel foliis squamiformibus adpressis memberanaceis obtecto; supra densissime (nonnunquam laxius) ramosi, ramis iterumque conferte ramulosis strictis, nitidiusculis, breviter cuspidatis, frondem subcomplanatam oblongam vel flabellaceam formantibus. Folia ramea patentia, stricta, e basi lata, cordata, auriculata, ovato-lanceolata, concava, raptim in subulam loriformem robustam valde tortam, fortiter argute distanter denticulatam angustata. Costa unica validiuscula, longe supra medium folium prolongata. Cellulae eis *S. pilifoliae* similes, sed alares numerosae, laxiusculae, aurantiacae, auriculas parvas sed notatas instruentes.

Fructus ignotus. Propagula viridia, articulata, brevia, fusiformia, inter folia (? axillaria) inveniuntur.

Hab. Japwo, Naga Hills, 2,900 m.; 7 December 1935 (339).

A remarkable species in the robust, regularly spirally twisted, sharply toothed acumen; the twisting may attain 1½ complete turns. The alar cells are conspicuous by their orange colour, but are much smaller and form smaller auricles than in *S. Borii;* they tend however to confirm the position of that species in the present genus.

It is remarkable that four species, three of them new, of this small genus of not more than fifteen or sixteen species, should occur in the limited area from which the present collections were made, and suggests that Assam must be considered the head-quarters of the genus. The Philippine Islands are the only region elsewhere known to contain as many as three species.

Pterobryopsis auriculata Dix. sp. nov. (Pl. I, fig. 10).

E robustioribus generis, *P. scabriusculae* (Mitt.) affinis et similis. Caulis secundarius 10-15 cm. longus, nunc sparse nunc conferte pinnatim ramosus, ramis parce brevissime ramulosis; omnes turgidi, densifolii, obtusi, vix nitidi. Folia patula, circa 2 mm. longa, latissime ovata, cochleariformia, supra cucullata, abrupte late breviter cuspidata, acuta, integra, ad basin auriculis pulchris haud magnis bene notatis praedita; costa unica tenuissima, circa dimidiam partem folii attingens. Cellulae lineari-rhomboideae, tenerrimae, laeves, basilares minime latiores, intra auriculas paucae lavae, hyalinae.

Fructus ignotus.

Hab. Bark of tree, 100 m., Charduar; 16 October 1934 (205), type. Manalur, Lower Palnis, Madura, 18 June 1926, coll. G. Foreau (370).

Nearest perhaps to *P. scabriuscula* (Mitt.), but quite distinct in the auriculate base. *P. conchophylla* (Ren. & Card.) is a much smaller plant with numerous alar cells. *P. madurensis* (Card. & Varde) with a considerable resemblance in habit has much less developed auricles and very numerous alar cells.

METEORIACEÆ.

Papillaria fuscescens (Hook.) Jaeg.—Several gatherings.

Meteorium Buchanani (Brid.) Fleisch.—Chingku, Naga Hills, 2,500 m.; November 1935 (355). A form with the long hair points of *M. Miquelianum*, but with non-plicate leaves.

Aerobryopsis denticulata Dix. sp. nov.

Pendula, extensa, mollis, viridis, habitu specierum Barbellae, e.g. *B. spiculata* (Mitt.); ramis percomplanatis, nunc sparsim, nunc confertius, aequaliter pinnatis. Folia caulina et ramealia subsimilia, late divaricata, e basi contracta cordata, breviter decurrente, amplexicauli, cordato-ovata, acuminata, acumine longo, tenui, saepe torto, argute denticulato. Margines plani, nullo modo undulati, ubique argute, fortiter denticulati. Costa tenuissima, circa medium folium attingens, interdum obsoleta. Cellulae praelongae, angustae, saepius uni—, interdum pluri-papillosae, papillis parvis; basilares subsimiles, alares perpaucae laxiores.

Fructus ignotus.

Hab. Satoi, Naga Hills, 2,150 m.; 4 December 1935 (367).

Distinct in its slender, complanate, Barbelloid habit, the nonundulate, sharply toothed margins, and long, narrow cells. In foliation it is perhaps nearest to *A. striatula*, but the marginal toothing and areolation are quite distinct.

Floribundaria floribunda (Doz. & Molk.) Fleisch.—Piri, Aka Hills; November 1934 (241), c. fr. Pestiferous Camp, 1,200 m., Piri, Aka Hills; November 1934 (221). This last is a peculiar form, very slender and delicate in habit, with irregular, not regularly seriate papillae, but with obscure cells, and very weak nerve. It may be *F. pseudo-floribunda* Fleisch, which however seems to me a poorly marked species.

Chrysocladium horridum Dix. sp. nov.

Habitus, color et magnitudo *C. phaei* (Mitt.); ab illa et affinibus differt toto coelo foliorum structura, cellulis nullo modo obscuris, nec opacis, sublaevibus vel 3-4-papillosis, papillis nunc altis, spiculosis, nunc minutissimis vel nullis. Folia superne marginibus undulatis, densissime acutissime denticulatis; cellulae alares distinctae, laxae, aurantiacae, alas parvas sed bene notatas instruentes.

Sterilis tantum nota.

Hab. Naga Hills, 1935 (272), type. Japwo, Naga Hills; 7 December 1935 (332).

Quite distinct from *C. phaeum* and the allied species in the pellucid, neither obscure nor opaque cells, sometimes highly 3-4-papillose, sometimes quite smooth. An unpublished species from Yunnan is in some respects very like it, but has different foliation, and the cells, though sparsely papillose as here are very opaque and obscure with the primordial utricle, which is not at all the case in the present plant.

Barbella enervis (Thw. & Mitt.) Fleisch.—Pestiferous Camp, 1,500 m., Piri, Aka Hills; November 1934 (226).

Lindigia asiatica Dix. sp. nov. (Pl. I, fig. 11).

E robustioribus generis. Sordide viridis. Caulis circa 8 cm. longus, flexuosus, compalanate pinnatim irregulariter ramosus, ramis usque ad 2 cm. longis, complanatis, 4-5 mm. latis. Folia divaricata, subsquarrosa, complanata, 3 mm. longa, e basi subcordata sensim attenuata, acumine stricto, tenuiacuminato, aciculari; margines plani, ubique argute denticulati. Costa ad basin sat valida, supra tenuis, circa 2/3 folii attingens. Cellulae latiuscule leneari-rhomboideae, laeves, parietibus tenuibus; ubique subsimiles, ad insertionem tantum laxiores.

Ditissime fructificans. Fructus ad ramos situs, perichaetia parva, bracteis breviter acuminatis; seta vix ultra 1 mm. longa, crassiuscula, laevis. Theca erecta, fusca, ovalis, 1 mm. longa, sicca macrostoma; operculum acute conico-curvirostellatum. Exothecii cellulae seriebus verticalibus, rectangulares, parietibus rectis, sat crassis. Peristomium pro thecae magnitudinem magnum; dentes usque ad .5 mm. longi, pallidi, madidi pulchre leniter recurvati, lanceolati, e basi angustati, angustissime acuminati, tenues, vix lamellati, ubique tenere regulariter papillosi, linea media leniter angulata, scutulis irregularibus, saepe subquadratis. Processus e membrana brevissima vel nulla filiformes, tenerrimi, breviores, sublaeves, hic illic rimosi. Spori 26-20μ laeves.

Hab. Him Parbat, 2,000 m.; 21 March 1934 (81). No doubt corticolous.

A prettily fruiting, graceful plant. In habit not unlike the above described *Jaegerinopsis integrifolia* (see Plate), though with less rigidly divaricate leaves; but the resemblance ends there. It is the first species of the genus to be found in Asia, and a very distinct one. Of the other nine species one is from Tropical Africa, one from Madagascar, the remainder from tropical or sub-tropical America.

C. Müller has divided the genus into two sections; Eulindigia with comparatively short stems and short, simple branches, linear-rhomboid cells, a very short seta, striolate peristome teeth and long-beaked lid, while Genucaulis has a very long stem, with long ramulose branches, elliptico-rhomboid cells, seta 4-7 mm., papillose teeth, and a short-beaked lid. The present plant has the vegetative characters and short seta of Eulindigia, the lid and papillose teeth of Genucaulis. It seems impossible, therefore to maintain this arangement, and it would be better to drop it, or to make the division depend on the character of the peristome teeth alone.

Meteoriopsis squarrosa (Hook.) Fleisch.—Shillong, 1,800 m.; September 1934 (202). With very young fruit.

Meteoriopsis reclinata (C.M.) Fleisch.—In several gatherings.

Aerobryum speciosum Doz. & Molk.—Pestiferous Camp, 1,200 m., Piri, Aka Hills; November 1934 (219). Hanging from branches, Bompur La, Aka Hills, 1,800 m.; November 1934 (234). The latter a fine plant, with stems a foot long, and nicely in fruit.

NECKERACEÆ.

Calyptothecium urvilleanum (C.M.) Broth.—Him Parbat, 2,000 m.; March 1934 (107). Hanging from branches, Bompur La, Aka Hills, 1,800 m.; November 1934 (238). Both represent a rather slender form. I have elsewhere (*Journ. of Bot.*, 1937, p. 121) given reasons for considering the Indo-Malayan *C. philippinense* Broth. to be identical with the Pacific species.

Calyptothecium sp.— Rubber tree, Charduar; November 1934 (207). A distinct species which is very near to *C. mysorense* Broth. ined. (Bryoth. E. Levier, 5,905), but differs in some slight respects, and I hesitate therefore to record it with certainty as that species.

Neckera himalayana Mitt.—(Syn. *N. longe-exserta* Hampe). Japwo, Naga Hills, 2,900 m.; October 1935 (320), c. fr. I have compared Hampe's type with Mitten's, they are exactly the same thing. The seta is remarkably long for the genus.

Neckeropsis gracilenta (Bry. jav.) Fleisch.—Gomarai, near Shillong, on bark of tree; August 1934 (174). New to Assam.

Himantocladium plumula (Nees) Fleisch.—Him Parbat, 1,800 m.; March 1934 (101).

Himantocladium scabrisetum Dix. sp. nov.

Strips rigida, habitu *H. flaccidi* aut *H. cyclophylli*. Saturate viridis. Rami haud flagellacei. Folia stricta, sicca vix mutata, rigide divaricata, caulina (nec ramea) transverse undulata, e basi latiore concava, breviter late oblonga, apice triangulari-rotundato, parce argute denticulato. Costa tenuissima, circa dimidiam folii partem attingens, saepe brevior, nonnunquam obsoleta. Cellulae medianae lineari-rhomboideae, superiores rhomboideae. Folia ramea angustiora, minora.

Dioicum videtur. Perichaetium longum, bracteis strictis, erectis, superne longe ligulatis, subacutis, integris. Seta circa 1 cm., scabra, ad basin laevis; crassiuscula. Theca e collo brevi turgide elliptica, deoperculata 2.5 mm. longa.

Peristomium pallidum, dentes teneri, vix lamellati, grossiuscule aequaliter papillosi; processus e membrana basilari perbrevi subaequilongi, perangusti, aciculares, dense alte papillosi. Operculum haud visum.

Hab. Naga Hills; 1935 (278).

So far as is known, this is the only species of the genus with scabrous seta. It also differs from its allies in the very thin, faint short nerve; the upper cells also are more elongate than in most species. *H. strictum* Dix. from Siam is the most closely allied, and may indeed be conspecific, but the fruit has not been found. It is still more rigid than the present plant, with the leaves rarely transversely undulate, sometimes longitudinally plicate, and with a rather longer and stronger nerve; but the differences are not very great.

Homaliodendron montagueanum (C.M.) Fleisch.—Him Parbat, 1,800 m.; March 1934 (107), c. fr. I name this on account of the almost simple or very slightly branched stems; but it scarcely differs from *H. javanicum* or *H. flabellatum* (with which it was growing) in any other respects.

Homaliodendron flabellatum (Dicks.) Fleisch.—Tako Senyak, Dafla Hills, 1,200 m.; March 1934 (105b), c. fr.

Homaliodendron scalpellifolium (Mitt.) Fleisch.—Pankim La, Abor Hills, 1934 (127), c. fr. Shillong, 1,200 m.; September 1934 (187), ♂ plant. Piri, Aka Hills, 2,750 m.; November 1934 (249, 251), c.fr. Japwo, Naga Hills, 2,500 m.; October 1935 (315), c. fr.

Homaliodendron longisetum Dix. sp. nov.

Robustum. Caulis primarius repens, dense tomentosus. Caulis secundarius inferne simplex, elongatus, foliis stipitis infernis squamiformibus, parvis, recurvis, acuminatis, supernis foliaceis, membranaceis, laxis, patentibus, acutis, integris. Caulis superne complanate dendroideus, flabellatus, ramis ad 2 cm. altis, nunc parce distanter pinnatis, nunc plus minusve dense bipinnatis. Folia percomplanata, eis *H. javanici similia,* sed costa multo validiore, longiore, saepe paullo infra apicem soluta. Cellulae rhomboideo-ellipticae, parietibus tenuibus.

Perichaetii bracteae breves, breviter late acuminatae, denticulatae. Fructus saepe numerosi. Seta 1.25-1.5 cm. longa, tenuis, inferne laevis, parte superiore sat alte papillosa. Theca pallide fusca, elliptica, leniter gibbosa, deoperculata circa 3 mm. longa; operculum longe curvirostre. Peristomium generis, albida. Calyptra nuda.

Hab. In forest, 2,900-3,200 m., Piri, Aka Hills; October 1933 (7, 29), type. Ibidem, 2,300 m., 17 November (246).

One of the most distinct species in the long, rather stout nerve, the seta elongate as in no other species, and papillose in the upper part. The fronds are sometimes laxly and slightly branched, as in *H. Montagueanum*, sometimes (in the same gathering and even on the same stem) densely bipinnate, as in *H. flabellatum,* showing the slight value that can be attributed to this as a character.

Handeliobryum assamicum Dix. sp. nov. (Pl. I, fig. 12).

Ab *H. setschwanico* et *H. himalayano* Broth. differt foliis versus apicem grosse et inaequaliter obtuse sinuato-denticulatis.

Hab. Rocks in stream, Piri, Aka Hills, 2,700 m.; 17 November 1934 (247).

An interesting link in the distribution of this recently known, striking and peculiar genus, between the Himalayan and Chinese localities. The two described species only differ from one another in habit; they are described as having the leaf apex entire or with a few minute denticulations; here they are constantly obtusely, rather coarsely, though not strongly sinuate-denticulate. It is obviously a more or less aquatic plant.

HOOKERIACEÆ.

Daltonia marginata Griff.—Piri, Aka Hills, 2,600 m.; November 1934 (243a). Mitten describes the calyptra as reaching to the middle of the capsule, but I find it, in Griffith's plant, as here, scarcely reaching below the lid. Griffith is the author of the specific name, not Mitten as Brotherus has it.

Daltonia perlaxiretis Dix. sp. nov. (Pl. I, fig. 13).

Robusta, elata, usque ad 2 cm. alta, caespitosa. *D. reticulatae* C.M. ceylonensi affinis, differt limbo folii angustiore, cellulis multo laxioribus, valde pellucidis, seta longiore, theca angustiore. Folia 3 mm. longa et paullo ultra, fusiformia, leniter (infra fortiter) carinata, longe, tenuissime cuspidata, limbus superne 2-3-seriatus; cellulae superiores hexagonae, 14-20 μ latae, inferne multo laxiores, omnes perpellucidae, parietibus tenuissimis. Costa sat longe sub apice desinens. Seta laevis, circa 8 mm. sub collo leniter geniculata, unde theca inclinata. Theca e collo distincto breviter cylindrica, atro-viridis. Operculum longiuscule acuate rostratum. Peristomium pulchre albidum; dentes densissime, altissime tenuissime papillosi, imperforati; processus simillimi sed angustiores.

Hab. Piri, Aka Hills, 2,500 m.; 17 November 1934 (264).

A very pretty little plant, in neat tufts, richly fruiting, with bluish green capsules in strong contrast to the large, white, persistent calyptra. The capsules are unusually narrow, and are inclined or even horizontal owing to the geniculation of the seta below the distinct collum. In *D. reticulata* the cells are about 8-14 μ wide, the capsule wider, the seta shorter.

Daltonia gemmipara Dix. sp. nov. (Pl. I, fig. 14).

Species valde abnormalis, corticola vel in aliis muscis epiphtytica, saturate viridis, caespitosa, gracilis, mollis, siccis foliis valde crispatis. Caules dense intricati, circa 1 cm. alti, crassi, rufi; folia conferta, flexuosa, saepe subfalcata, circa 2 mm. longa, flexuosa vel subsigmoidea, e basi latiore ligulata, obtusa, profunde sed late carinato-canaliculata; costa lata, carinam implens, superne parum angustata, sub summo apice soluta. Margines folii superne late fortiter revoluti, unde folium revolute subtubulosum fit. Limbus superne sat angustus. Cellulae superiores hexagono-rectangulares, irregulares, perchlorosae, parietibus tenuibus; inferne sensim laxiores. Folia suprema falcata, saepe apice in penicillium chlorophyllosum vel hyalinum expanso, e filis articulatis tenerrimis densissime confertis instructum.

Fructus ignotus.

Hab. Pulebudze, Naga Hills, 1,850 m.; on rotten wood mixed with other mosses and often growing on them; August 1935 (293c).

A very remarkable plant. The highly chlorophyllose, more or less rectangular cells are unusual, but not unknown in the genus. The leaves are ligulate from a slightly wider base, and in the upper part more or less tubular, but from the widely *revolute*, not involute margins; the nerve is rather wide throughout, occupying a deep channel in mid-leaf. The upper leaves are often gemmiparous, in this case being falcate at the tip, and the rather obtuse apex emits a small, dense felt of extremely delicate, but wide, articulate threads, forming a penicillate or flabellate head, between .25 and .5 mm. in length. I have found very small, fusiform, articulate gemmae on these, but am doubtful if these were in situ; it is more probable that the threads themselves are immature, and would later develope into articulate, detachable gemmae.

Hookeria acutifolia Hook.—In forest, Piri, Aka Hills, 2,700-3,300 m.; 1934 (39), c. fr.

Chaetomitriopsis glaucocarpa (Reinw.) Fleisch.—Pankim La, Abor Hills, 1934 (121, 131, 146), c. fr.

HYPOPTERYGIACEÆ.

Cyathophorum intermedium Mitt.—Balipara Frontier Tract, foot of Aka Hills, under 300 m.; November-December 1933 (50b). Only a scrap.

Dendrocyathophorum paradoxum (Broth.) Dix.—Him Parbat, 2,000 m.; March 1934 (95). I have already pointed out in some Notes in *Journ. of Bot.*, 1937, p. 125, that this plant, described as a new genus and species by me in *Journ. of Bot.*, 1936, p. 7, was found to be identical with the Japanese moss, *Hypopterygium paradoxum* Broth. Its generic distinction, between Hypopterygium and Cyathophorum, is unquestioned, and its name must be as above. It is a similar instance of geographical distribution to that of *Orthomniopsis japonica*, given above.

FABRONIACEÆ.

Fabronia assamica Dix. sp. nov.

E minutissimis generis. Folia paullo latiora quam in *F. secunda*, brevius pilifera, minute denticulata, cellulis multo brevioribus, plerumque 3-4 × 1. Costa pertenuis, saepe obsoleta. Theca perminuta, operculata vix .75 mm. longa. Operculum conicum.

Hab. Shillong, 1,700 m.; 1 September 1934 (186).

Nearest to *F. secunda* in the narrow leaves, but more delicate, with laxer, smaller leaves, much shorter cells, and very minute capsule. The lid is bluntly conical when moist, but becomes apiculate when dry. *F. minuta* Mitt. has much denser foliation and much wider leaves.

LESKEACEÆ.

Pseudoleskeopsis decurvata (Mitt.) Broth.—Somma, 100 m.; March 1934 (79).—This has the basal sinus of the leaf nearer to that of *P. decurvata* than *P. orbiculata*, as figured by Thériot, but I must confess I find this character rather ill defined and elusive; and I am inclined to doubt the value of several of the species described in this genus. The nerve of the perichaetial leaf here is long, but not nearly percurrent. The margin is mostly plane, but sometimes recurved on one side.

THUIDIACEÆ.

Haplocladium subulaceum (Mitt.) Broth.—Naga Hills; 1935 (280).

Claopodium nervosum (Havr.) Fleisch.—Balipara Frontier Tract, foot of Aka Hills, below 300 m.; November-December 1933 (50, 61).

Claopodium assurgens (Sull. & Lesq.) Card.—Tree trunk, Dulungmukh, 200 m.; February 1934 (71).

Thuidium bifarium Bry. jav. var. pertenue Lac.—Bark of tree, Aka Hills, 300 m.; November 1934 (216). A well marked variety, which may be, as Fleischer describes it, a distinct species. It is characterized, for one thing, by a roughish seta. It has only been recorded from Celebes.

Thuidium Brotheri Salm.—Pankim La, Abor Hills; 1934 (120, 130, 134). I am very doubtful whether this be distinct from *T. asperulisetum*.

Thuidium asperulisetum Ren. & Card.—Balipara Frontier Tract, foot of Aka Hills, under 300 m.; November-December 1933 (43 p.p.). Pulebudze, Naga Hills, 600 m.; Aug. 1935 (293).

Thuidium Meyenianum (Hampe) Jaeg.—Charduar, 1934 (75).

Thuidium subpellucens Dix. sp. nov.

Thuidiella *T. squarrosulo* Ren. & Card. affine; differt praecipue cellulis haud opacis, valde pellucidis, et costa dorso laevi. Bipinnatum. Saturate viride. Seta laevis, theca inclinata, curvata.

Hab. Piri, Aka Hills, 2,750 m.; 17 November 1934 (244).

Very similar to *T. squarrosulum* in the habit, squarrose stem leaves, foliation and fruit, but differing entirely in the cells, which though bearing the same high central papilla are very pellucid, instead of being opaque and obscure; the nerve also, while prominent at the back, is less so, and smooth, while there it is markedly roughened or denticulate.

Thuidium orientale Mitt.—Bhalukpung, 300 m., Aka Hills; November 1934 (213).

Thuidium cymbifolium (Doz. & Molk.) Bry. jav.—Several gatherings.

Actinothuidium Hookeri (Mitt.) Broth.—Japwo, Naga Hills, 2,750-3,000 m.; December 1935 (335).

AMBLYSTEGIACEÆ.

Ortholimnobium Dix. gen. nov. Amblystegiarum.

Humilis. Caulis vage ramosus. Folia subcomplanata, latissime cordata, ecostata, alis decurrentibus parvis, laxis, pellucidis. Seta breviuscula. Theca

erecta, symmetrica, elliptica, leptodermica; exothecii cellulae laxae, hexagonae. Peristomium albidum, dentes pellucidi, inferne transverse, medio oblique vel verticaliter striolati, superne leniter papillosi; intus sat alte lamellati. Processus subaequilongi, perpellucidi, laeves vel sublaeves, rimosi, ad dentes plus minusve adhaerentes; membrana basilaris humillima. Cilia O. Spori parvi. Operculum acute conicum.

Ortholimnobium Borii Dix. sp. unicum. (Pl. I, fig. 15).

Laxe caespitosum, gracilescens pallide viride, subnitidum. Caulis vage ramosus, vix radiculosus; rami valde irregulares, teneri, molles, usque ad 2 cm. longi, complanati, saepe attenuati. Folia laxiuscula, 1 mm. longa, 1 mm. lata, latissime cordata, breviter acute cuspidata, integerrima; costa nulla vel raro brevissima, bina; cellulae perangustae, lineares, pellucidae, parietibus tenuibus, subconflatis; basilares medianae paullo laxiores, ad angulos decurrentes abrupte dilatatae, hyalinae, tenerae, late rectangulares, auriculas decurrentes optime notatas instruentes.

Dioicum videtur. Flores cauligeni, interdum ramigeni. Perichaetia minuscula, bracteae erectae, appressae, brevissime late cuspidatae. Seta circa 1.25 cm. longa, laevis, rubra; theca circa 2 mm. longa, erecta, raro indistincte inaequalis. Spori circa 15 μ.

Hab. Piri, Aka Hills, 2,300 m.; 17 November 1934 (252).

The affinities of this plant are not quite certain, but vegetatively it appears not unlike some Hygrohypna, and I think should be placed near that genus. The structure of the teeth is rather peculiar. The dorsal plates are very finely but distinctly transversely striolate, to about the middle of the teeth; a few plates then are irregularly striolate, obliquely or vertically; and the upper part of the teeth is faintly papillose or almost smooth. The widely cordate leaves, almost or quite as broad as long, will enable the plant to be recognized at once from anything likely to be confused with it.

BRACHYTHECIACEÆ.

Brachythecium Buchanani (Hook.) Jaeg.—Kanyang, 1,700 m.; Naga Hills; November 1935 (365).

Oxyrrhynchium riparioides (Hedw.) Jenn.—Shillong, 1,800 m.; September 1934 (202 p.p.).

Oxyrrhynchium Mulleri (Lac.) Broth.—In forest, 3,000-3,300 m., Piri, Aka Hills; October 1933 (6).

Nov. var. **minus** Dix. Omnibus partibus, praecipue foliis, minus. Folia vix 1.25 mm. longa.

Piri, Aka Hills, 2,900 m.; November 1934 (250), type of var. Rocks in stream, 2.750 m., Piri; November 1934 (259).

So slender and different from the ordinary plant that I had at one time decided to describe it as a new species; there is really, however, so far as I have been able to ascertain, nothing but the size to distinguish it from *O. Mülleri,* and the presence of that species in the near vicinity tends to confirm this. Both plants were in fruit, which seems to show no difference from the type, except that the seta is a little shorter.

Eurhynchium dumosum (Mitt.) Jaeg.—In forest, 2,900-3,300 m., Piri, Aka Hills; October 1933 (1). Shillong, 1,800 m.; September 1934 (20 p.p.).

Rhynchostegiella scabriseta (Schwaegr.) Broth.—Pankim La, Abor Hills; 1934 (141).

Rhynchostegiella assamica Card. & Dix.—Charduar, 200 m.; February 1934 (67).

Rhynchostegiella percomplanata Dix. sp. nov.

R. aciculae Broth. & Par. affinis, sed multo major, valde complanata, ramis ad 1 cm. longis, pulchre plumosis. Folia 2.5 mm. longa, lanceolata, acuminata, vel integra, vel plus minusve distincte denticulata. Cellulae lineari-rhodmboideae, elongatae, perangustae, basilares 2-3-seriatim multo laxiores, hyalinae.

Perichaetium parvum, bracteis brevibus, patulis, stricte acuminatis, denticulatis. Seta circa 1.25 cm. alta, laevis.

Hab. Bark of tree, 200 m., Piri, Aka Hills; 13 November 1934 (210).

Very near to *R. acicula*, but much more robust, and with leaves nearly always—and often sharply—denticulate. It belongs to the group of which *Hypnum menadense* Bry. jav. may be considered the type, which seem equally at home in this genus or in Rhynchostegium.

Rhynchostegium herbaceum (Mitt.) Jaeg.—Balipara Frontier Tract, foot of Aka Hills; November-December 1933 (53). Pestiferous Camp, Piri, Aka Hills, 1,200 m.; (228, 222). Wokka Hill, Naga Hills, 1,850 m.; October 1935 (289). Khüvubhu, Naga Hills, 1,500 m.; November 1935 (344). All in fruit.

Rhynchostegium Hookeri Jaeg.—Pestiferous Camp, Piri, Aka Hills, 1,200 m.; November 1934 (220).

Rhynchostegium Duthiei C.M. MS. sp. nov.

Sat robustum, haud nitidum. Rami densi, suberecti, haud complanati, sicci curvati, subobtusi, Folia imbricata, saepe leniter secunda, 2 mm. longa, cordato-ovata, breviter acute acuminata, apice semitorto, denticulato. Costa sat angusta, sub acumine soluta. Cellulae angustissimae, basilares omnes laxiores.

Autoicum. Perichaetia majuscula, bracteis superne stricte late acuminatis, denticulatis, patulis. Seta circa 1.5 cm. alta, laevis, rubra; theca turgidiuscule elliptica, curvata, gibbosa, fusco-aurantiaca. Operculum longirostre.

Hab. Arnigadh, 1,675 m., Mussoorie, N.W. Himalaya, leg. W. Gollan, 13 December 1895; det. Brotherus (E. Levier-Bryoth. exot., No. 72), type. Simla, March 1902, leg. Mrs. Roper, Herb. H. N. Dixon (66, 76). Ibidem, 1924, leg. Dr. Ghose, 1924, Herb. H. N. Dixon (99). Moist places, 3,350 m., Bias Valley, Kulu, N.W. Himalaya, 9 September 1928; leg. Badhwar (1091). Piri, 2,900-3,300 m., Aka Hills, Assam, October 1933, leg. N. L. Bor (31).

This species, distributed by Levier in the Bryotheca Exotica, has not been published. It is distinguished by its non-complanate, often secund leaves, rather wide and short, and half-twisted at apex, by the branches curved when dry, and the very narrow upper cells; it is in fact of more Eurhynchioid habit than most species. The Assam plant is more robust, with larger leaves, longer seta, and shorter lid, but I think belongs here.

Rhynchostegium pellucidum Dix. sp. nov.

Gracile; saturate viride; inter alios muscos repens. Caulis prostratus, ad 6 cm. longus, pinnatus, ramis brevibus. Folia laxiuscula, vix complanata, sicca parum contracta, flexuosa, vix nitida, parva, circa 1.5 mm. longa, lanceolata, tenui-acuminata, minute denticulata, costa tenuissima, brevis, vix medium folium attingens. Cellulae lineari-rhomboideae, pellucidae, infra sensim laxiores, basilares laxae, alares majusculae, rectangulares, hyalinae.

Fructus ignotus.

Hab. On dead branch, 1,850 m., Pulebudze, Naga Hills, 8 August 1935 (293f).

A delicate plant with narrow leaves, and of a distinct habit; its position is a little doubtful. In leaf form it is not unlike *Rhynchostegiella percomplanata* described above, but the habit, and the position of the leaves when dry, are quite different, and it has not the characters of a Rhynchostegiella.

SYMPHYODONTACEÆ.

Symphyodon scabrisetus Dix.—In forest, 2,700-3,300 m., Piri Aka Hills; October 1933 (13). Tako Senyak, Dafla Hills, 1,400 m.; March 1934 (102).

ENTODONTACEÆ.

Entodon flavescens (Schwaegr.) Jaeg.—Chingku, Naga Hills, 2,600 m. November 1935 (352).

Entodon luridus Griff.—Pankim La, Abor Hills; 1934 (126). This is *E. luridus* according to Brotherus' arrangements; I have not seen Griffith's plant, which, indeed, appears not to exist.

Entodon ovicarpus Dix. sp. nov.

? Erythropus. Late expansus, sordide viridis, vix nitidus. Rami haud complanati, turgidi, subjulacei, obtusi. Folia conferta, e basi paullo contracta ovata, breviter, raptim, acute vel subobtuse cuspidata, perconcava, fere cochleariformia, subintegra; cellulae angustiusculae, alares magnae, subhyalinae, haud partem majorem latitudinis folii occupantes.

Bracteae perichaetii longe, flexuose acuminati. Seta vix 1 cm. longa, (matura) pallide rubra, crassiuscula. Theca turgide ovata, deoperculata 2.5 mm. longa; exothecii cellulae laxae, hexagonae, fere isodiametricae, parietibus tenuibus. Peristomium fusco-rubrum, dentes breves, marginati, infra horizontaliter, supra verticaliter striolati. Processus rudimentarii. Operculum haud visum.

Hab. Pankim La, Abor Hills, inter 300 et 2,900 m.; 1934 (132).

Quite distinct in the subjulaceous, obtuse branches, short seta, ovoid capsule, lax exothecium cells, and rudimentary processes. It is not certain to which of the two divisions of the genus it belongs as the fruit is in all cases overripe, and the seta when younger may have been either yellow or red.

Entodon plicatus C.M.—Newly, 300 m., January 1934 (72). Dafla Hills, March 1934 (108).

Erythrodontium julaceum (Hook.) Par.—Several gatherings.

Pylaisia aurea (Hook.) Broth.—Shillong, 1,800 m.; September 1934 (184).

Pylaisiopsis speciosa (Wils.) Broth.—Naga Hills: 1935 (283). I believe this has not been collected since its first discovery by Hooker. It quite sustains the peculiar characters as given by Brotherus. The outer teeth of the peristome are as shown by him in his figure, but the abrupt transition from the lower half to the subula is even more strongly marked, forming indeed a distinct square shoulder. The processes when mature are split from top to bottom, and each half curves away from the other and outwards in a graceful and striking manner. The spores are very large, but I have not found them nearly equalling the measurements given by Brotherus. It is a remarkable plant.

Campylodontium flavescens (Hook.) Bry. jav.—Him Parbat, 2,000; March 1934 (92).

Stereophyllum anceps (Bry. jav.) Broth.—On *Ficus elastica*, Charduar; June 1934 (161).

SEMATOPHYLLACEÆ.

Clastobryum subplanulum Broth.—Piri, Aka Hills, 2,500-3,300 m.; November 1934 (243b, 254, 261), c. fr. These specimens differ somewhat from one another and from the type, but they must clearly all be referred to the same species. The propagula when present are very densely crowded, and may be very finely papillose. The plant is bi-tripinnate in its branching.

Aptychella Borii Dix. sp. nov. (Pl. I, fig. 17).

Pro genere sat robusta, viridis. Caulis prostratus, radiculosus, laxe ramosus; rami prope apicem saepe fila articulata axillaria hyalina densissime fasciculata laevia emittentes. Folia complanatula, 2-2.5 mm. longa, concava, ovata, breviter acute cuspidata, plerumque integra, subecostata. Cellulate laeves, angustissimae, basilares saepe aurantiacae, ad angulos numerosae, laxae, hyalinae, alas bene notatas, teneras, decurrentes formantes.

Fructus ignotus.

Hab. Pulebudze, Naga Hills, 1,850 m.; 8 August 1935 (293d). Nearest to *A. heteroclada* Fleisch., but deep green, more rigid, the leaves with shorter points, and the brood-filaments colourless.

Aptychella planula (Mitt.) Fleisch.—Chingku, Naga Hills, 2,500 m.; November 1935 (358), c. fr.

Hageniella assamica Dix. sp. nov. (Pl. I, fig. 19).

Densissime caespitosa viridis, vix nitida, ramis brevibus, leniter curvatis, densifoliis, brevissime cuspidatis. Folia conferta, saepe secunda, subfalcata, minuta, caulina circa 1 mm. longa, e basi contracta late ovata cochleariformia, raptim tenuissime acuminata, subpilifera, enervia; ramea minora, magis sensim brevius acuminata. Cellulae parvae, perangustae, subrhomboideae, pellucidae, dorso nunc laeves, nunc sat fortiter sed tenere papillosae; alares sat numerosae,

perdistinctae, hyalinae, majusculae, vix vesiculosae, alte ad margines adscendentes; basilares flavidae.

Dioicum videtur. Perichaetii bracteae erecto-patentes; e basi lata, convoluta, raptim in acumen longum, acutissimum, arcte, fortiter denticulatum contractae. Seta 1-1.25 cm. longa, tenuis, laevis. Theca horizontalis, elliptica, parva, deoperculata 2 mm. longa, fusco-purpurea, sicca sub ore constricta; exothecii cellulae laxae, subisodiametricae, parietibus valde flexuosis. Operculum rostellatum. Peristomium flavidum, dentes ad basin conjuncti, inferne dense striolati, superne sublaeves; intus fortiter lamellati; endostomium plus minusve papillosum, processus latiusculi, rimosi, variabiles. Cilia ? Spori circa 22 μ, laete virides.

Hab. Japwo, Naga Hills, 2,750 m.; October 1935 (305).

A rather larger plant than *H. sikkimensis*, of quite different colour, with longer, subpiliferous points to the stem leaves, longer capsule, very different perichaetium, and more regularly developed peristome.

Hageniella isopterygioides Dxi. sp. nov. (Pl. I, fig. 18).

Dense caespitosa, humilis, nitida. Caulis ramosus et ramulosus, rami percomplanati, haud curvati. Folia parva, complanata, divaricata, eis *H. sikkimensis* forma subsimilia, sed longius acuminata; cellulae omnino laeves, alares utrinque 3-4, magnae, subvesiculosae, hyalinae vel flavae, supra-alares paucae, hyalinae, majusculae. Perichaetii bracteae eis *H. assamicae* similes sed breviores, argute, distanter denticulatae. Seta circa 1 cm. longa, inferne intense rubra, theca erecta, plerumque omnino symmetrica, structura ei *H. assamicae* similis. Peristomium simile, sed processus magis regulares, angustiores, dentibus aequilongi, rimosi. Cilia O.

Hab. Chingku, Naga Hills, 2,650 m.; 5 November 1935 (356).

That this is a Hageniella is not quite certain, the capsule being erect and symmetrical, the leaves complanate, glossy, and quite smooth. On the other hand the structure of the capsule and the peristome are exactly the same as in the last species, which is certainly a Hageniella, and the cell structure, apart from the papillae, quite similar. It seems hardly desirable to create a new genus for it, on account of the above differences, while in other respects so closely allied.

There is a curious resemblance between this plant and *Leiodontium complanatum* described below, in habit, leaf form, size, and capsule; so much so that they might easily be confused. The principal difference, and of course an important one, in the leaf, is the Sematophylloid alar cells in the present plant; but the Leiodontium also has differentiated alar cells of something the same form, though on a much smaller scale, and less vesiculose. The peristome is remarkably similar in both, until examined with a high power, when the teeth of the Leiodontium (which moreover are rather irregular) are seen to be smooth, not striolate. The capsule there also is wider and more ovoid, with rather smaller exothecium cells.

Hageniella it will be remembered was created by Brotherus for a Sikkim species, and the same author added a second species later from Hawaii. It is interesting that two further species should have been collected from Assam.

Acanthocladium penicillatum (Mitt.) Broth.—In forest, 2,700-3,300 m., Piri, Aka Hills; October 1933 (36). Pankim La, Abor Hills, 1934 (147). Bompur La, Piri, Aka Hills, 1,800 m., on tree trunk, November 1934 (237). Piri, 2,500 m.; April 1934 (242, 267). Japwo, Naga Hills, 2,700 m.; October-November 1935 (298, 308). Nearly all in fruit. Forming flat, dense patches, closely interwoven.

Acanthocladium tanytrichum (Mont.) Broth.—Bompur La, Piri, Aka Hills, 1,800 m.; November 1934 (237). Piri, 3,000 m.; November 1934 (267d). Both are somewhat off-type.

Acanthocladium baculiferum Dix. sp. nov. (Pl. I, fig. 20).

Caulis prostratus, densissime pinnatus atque fasciculato-ramosus, ramis erectis, iterumque ramulosus, ramulis parvifoliis, strictis, gracilibus, baculiformibus. Folia caulina parva, e basi vix contracta, oblongo-ovata, concava, breviter acutata, integra, ecostata. Cellulae parvae, angustissimae, lineares, parietibus incrassatis; basilares flavidae, perincrassatae, alares utrinque circa 3, magnae, vesiculosae, aurantiacae, supra-alares sat numerosae, parvae, sub-

quadratae, hyalinae. Folia ramea breviora, latiora, saepe subdenticulata; ramulina erecta, conferta, angustiora, minora, integra. Cetera ignota.

Hab. Japwo, Naga Hills, 2,750 m.; 27 November 1935 (309).

A peculiar plant, possibly belonging to Acroporium, but recognizable at once by the densely pinnate and fastigiate branching, with very numerous slender rod-like branchlets; by the short, broad leaves, only rarely with a few obtuse apical teeth.

Giammella pterogonioides (Griff.) Broth.—Shillong, 1,600 m.; September 1934 (199), c. fr. The peristome is a little longer than as figured by Brotherus, and this is also the case with specimens at Kew. The lowest alar cells are sometimes short, but sometimes distinctly elongate.

Chionostomum rostratum (Griff.) C.M.—Shillong, 1,600 m.; September 1934 (189, 195).

Foreauella orthothecia (Schwaegr.) Dix. & Varde (*Foreauella indica* Dix. & varde; *Hypnum orthothecium* Schwaegr. On *Litora* Bhassiana, Satai, 200 m.; August 1934 (179), c. fr.

For the synonymy of this plant see *Journ. of Bot.*, 1937, p. 129.

Brotherella erythrocaulis (Mitt.) Fleisch.—Pankim La, Abor Hills, 1934 (135).

Brotherella ambylostega (Mitt.) Broth.—In forest, 2,700-3,300 m., Piri, Aka Hills; October 1933 (32). Japwo, Naga Hills, 2,750-3,300 m.; December 1935 (335).

Brotherella filiformis Dix. sp. nov.

Gracilis, habitu fere *Hypni cupressiformis* var. *filiformis;* arcte, late caespitosa, pallide viridis. Caulis dense pinnatus, ramis parallelibus, filiformibus, strictiusculis. Folia parva, vix 1 mm. longa, regulariter falcato-decurva, e basi ovali concava, raptim angustissime acuminata, acumine basi subaequilongo, falcato, subpilifero, denticulato. Costa subnulla. Margines plani, vel apud basin leniter explicati. Cellulae perpellucidae, angustae, basilares flavae, alares paucae, vesiculosae, hyalinae, flavidae, majusculae.

Bracteae perichaetii suberectae, acumine elongato, subulato, leniter flexuoso, argute denticulato. Seta circa 1 cm. longa, infra thecam arcuata, unde theca inclinata, deoperculata circa 2 mm. longa, e collo brevi curvato subcylindrica, leniter curvata, fusca, infra orificium leniter contracta. Operculum acute rostellatum.

Hab. Japwo, Naga Hills, 2,750 m.; October 1935 (304), type. Ibidem (302). Ibidem, 2,600 m.; 27 October (321). Purobami, Naga Hills, 2,300 m.; 28 October 1935 (360), forma robustior.

Very near to *B. lepida* (Mitt.), but differing in the more slender habit, straight, narrow branches, more falcate, smaller leaves very abruptly narrowed to a longer, subpiliferous subula. *B. Harveyana* (Mitt.) has less falcate leaves and quite symmetrical, not curved capsule.

Brotherela falcata (Doz. & Molk.) Fleisch.—Piri, Aka Hills, 3,000 m.; November 1934 (261c).

Meiothecium microcarpum (Harv.) Mitt.—On bark, Charduar; August 1934 (172).

Sematophyllum caespitosum (Sw.) Mitt.—Shillong, 1,400 m.; 1934 (166).

Trichosteleum hamatum (Doz. & Molk.) Jaeg—On a rock, Bompur La, Aka Hills, 1,850 m.; November 1934 (231). A pale green form, with leaves less strongly falcate than usual, and coarse papillae; the seta very rough in the upper half.

Trichosteleum Boschii (Doz. & Molk.) Jaeg.—Fallen tree, Dharibati, 100 m.; November 1934 (209). A rather striking form, the leaves with quite short points. The papillae are high, not conical but cylindric, often especially so on the perichaetial bracts. The capsule is slightly mamillose.

Taxithelium kerianum (Broth.) Broth.—Balipara Frontier Tract, foot of Aka Hills; November-December 1933 (65).

Taxithelium laeviusculum Dix. sp. nov.

Dense, late, humillime caespitosum, laete virens, nitidum, gracile. Caulis brevis, pinnatus, ramis brevibus, complanatis. Folia complanata, patentia,

leniter decurvo-falcata, e basi parum contracta, asymmetrica, lanceolata, breviter acuminata. Margines plani vel hic illic angustissime recurvi, superne denticulati. Cellulae angustae, lineari-rhomboideae, plerumque laeves, raro perindistincte humillime seriato-papillosae; basilares seriebus circa 2 laxae, hyalinae, alares vix distinctae. Costa bina, plerumque bene evoluta, circa tertiam partem folii attingens.

Autoicum. Perichaetium majusculum, bracteis patulis, tenui-acuminatis, denticulatis. Seta circa 1 cm. longa, infra intense purpurea, superne arcuata. Theca parva, curvata (immatura), operculum conicum, apiculatum.

Hab. Him Parbat, 2,000 m.; 21 March 1934 (97).

Except for the very faint seriate papillae which occur at times, this might be an Isopterygium. The habit, however, is like that of some Taxithelia, and I place it here, though with some hesitation. *I. lignicola* (Mitt.) is like it, but has nerveless, entire leaves.

HYPNACEÆ.

Plagiothecium neckeroideum Bry. eur.—Japwo, Naga Hills, 2,750 m.; November 1935 (306), c. fr.

Isopterygium Textori (Lac.) Jaeg.—In forest, 1,700-3,300 m., Piri, Aka Hills, October 1933 (38).

Isopterygium albescens (Schwaegr.) Jaeg. In forest, 1,700-3,300 m., Piri, Aka Hills; October 1933 (25).

Isopterygium pallidum (Mitt.) Jaeg.—On *Ficus elastica,* Charduar; July, 1934 (177).

Hypnum binervosum Dix. sp. nov.

Sat robustum, dense, late caespitosum, pulchre aureum. Caulis sat regulariter pinnatus, ramis 3-4 mm. longis. Folia regulariter aequaliter disposita, fortiter circinata, circa 1.5 mm. longa, ad insertionem haud contracta, oblongo-lanceolata, longe tenui-acuminata, integra, marginibus planis. Costa plerumque duplex, cruribus duobus parallelis, validiusculis, alte in lamina prolongatis. Cellulae angustissimae, ad basin parum laxiores, tantum infra insertionem serie transversali majores, hyalinae; alares O.

Dioicum. Perichaetium conspicuum, vagina longa, magna; bracteae membranaceae, albidae, tenerae, e basi erecta breviter loriformiter reflexae, leniter denticulatae. Seta intense purpurea, 1 cm. alta (immatura), calyptra alba nitidiuscula. Theca haud visa.

Hab. Japwo, Naga Hills, 2,750-3,300 m.; 7 December 1935 (329).

A very pretty species in the golden colouring and the very regular, circinate foliation, as well as in the nerves, usually composed of two parallel branches, not united at the base, and often reaching quite high in the leaf base.

Ectropothecium buitenzorgii (Bél.) Jaeg.—Tako Senyak, Dafla Hills, 1,400 m.; March 1934 (110), c. fr.

Ectropothecium cyperoides (Hook.) Jaeg.—Naga Hills; 1935 (279).

Ectropothecium dealbatum (Hornsch. & Reinw.) Jaeg.—Balipara Frontier Tract, foot of Aka Hills; November-December 1933 (47, 62), c. fr.

Ectropothecium ramuligerum Dix. sp. nov.

E. Zollingeri (Bry. jav.) affine. Atro-viridis, late humillime expansum, haud nitidum. Caulis vage ramosus, ramis percomplanatis, tenuibus, inaequalibus, attenuatis, saepe ramulos microphyllos plus minusve elongatos sparsos emittentibus. Cellulae angustae, subconflatae, basilares paullo laxiores, breviores, sensim in alares parvas, breviter rectangulares vix notatas transeuntes. Folia sat laxa, complanata, asymmetrica, lanceolata, leniter cultriformia, breviter acute acuminata, denticulata, subecostata.

Autoicum. Bracteae perichaetii paucae, sat parvae, breviter late acuminatae, subdenticulatae. Seta circa 1 cm. vel paullo ultra, atropurpurea, laevis, apice arcuato. Theca subpendula, e collo subaequilongo oblonga, atrofusca, sub ore contracta.

Hab. Balipara Frontier Tract, foot of Aka Hills, 100-300 m.; November-December 1933 (43).

Allied to *E. Zollingeri,* but autoicous, with more narrowly acuminate, denticulate leaves, and small perichaetium. The microphyllous ramuli seem characteristic.

In the autoicous inflorescence it is near *Glossadelphus amboinensis* Fleischer, but from the description that is a smaller plant, with oval, acute, not acuminate leaves, and a longer seta.

Vesicularia reticulata (Doz. & Molk.) Broth.—In forest, 1,700-3,300 m., Piri, Aka Hills; October 1933 (15). Satai, on a bank; August 1934 (175). Khüvubhu, Naga Hills, 1,500 m.; November 1935 (345).

HYLOCOMIACEÆ.

Ctenidium lychnites (Mitt.) Broth.—Japwo, Naga Hills, 2,750 m.; October 1935 (301).

Leptohymenium tenue (Hook.) Schwaegr.—Japwo, Naga Hills, 2,700-3,300 m.; December 1935 (325, 327). Ibidem, 2,700 m.; October 1935 (319). A form with narrow capsules, branches very little curved when dry, deep orange brown leaves, rather widely spreading when dry.

Macrothamnium submacrocarpum (Hampe) Fleisch.—Several gatherings.

Macrothamnium macrocarpum (Reinw. & Hornsch.) Fleisch.—Several gatherings.

Leiodontium complanatum Dix. sp. nov. (Pl. I, fig. 16).

Pusillum. Corticola, dense caespitosum, humile, pallide viride, haud nitens, Caulis conferte, complanate, stricte pinnatim brevissime ramosus; rami paucos mm. longi, saepe iterum ramulosi; interdum inter folia superiora fila articulata sat numerosa axillaria, inaequalia, laevia emittentes; gemmae fuscae sphaericae circa 50 μ latae, laeves, indivisae, brevissime stipitatae, singulae in foliorum axillis paucae inveniuntur. Folia ovata vel ovato-lanceolata, minuta, .3-.4 mm. longa, breviter, subacute vel obtuse acutata, ecostata, minute crenulata, vel denticulata; cellulae breviter rhomboideae, variabiles, 3 × 1-6 × 1, marginales breviores, alares sat numerosae, subquadratae, alas parvas sed bene notatas saepe coloratas instruentes.

Bracteae perichaetii breves, late acutatae, nunc subintegrae nunc argute denticulatae. Seta 1 cm. longa, tenuissima; theca erecta, elliptica, minuta, 1 mm. longa; operculum oblique rostellatum; exothecii cellulae laxae, hexagonae, longitudinaliter seriatae, parietibus tenuibus. Annulus O. Spori 13-20 μ, saturate virides. Peristomium pallidum; dentes ad basin arcte conjuncti, laeves, pellucidi, sed solidi, lamellis intus valde prominentibus. Endostomium imperfectum, processus ad dentes adhaerentes.

Hab. Japwo, Naga Hills, 2,400 m.; October 1935 (314), type. Chingku, Naga Hills, 2,450 m.; 5 November 1935 (359).

No. 359 has a slightly different habit, with rather more narrowly pointed leaves, but is otherwise identical.

It is unusual to find a moss bearing two distinct forms of gemmae and at the same time fruiting.

The genus was founded by Brotherus in 1929 for two species of moss collected by Handel-Mazzetti in N. W. Yünnan. The present plant is smaller and very different in the complanate habit, and the leaf form and structure, but the fruiting characters are identical, except that the outer teeth are not perforate here, and the inner are very poorly developed. Brotherus describes the alar cells not differentiated in *L. gracile,* but I find them frequently in the Yünnan plant showing a small but distinct group of laxer, hyaline alar cells, sometimes reaching an appreciable distance up the margin.

I have referred to the curious resemblance between this plant and *Hageniella isopterygioides* under that species.

The Genus Leiodontium is allied to Microctenidium Fleisch.

POLYTRICHACEÆ.

Atrichum obtusulum C.M.—Paona, Naga Hills, 2,150 m.; September 1935 (282). Japwo, Naga Hills, 2,450 m.; October 1935 (317).

Atrichum pallidum Ren. & Card.—In forest, 2,700-3,300 m., Piri, Aka Hills; October 1933 (34).

Pogonatum contortum (Menz.) Lesq. nov. var. **robustum** Dix. Omnibus partibus majus. Folia 1.25-1.5 cm. longa, dense, argute dentata; folii basis longior, cellulis magis elongatis. Seta longior, theca major, longior, 8 mm. longa. *Hab.* In forest, 2,700-3,300 m., Piri, Aka Hills; October 1933 (8).
This extends the distribution of the species westwards considerably.

Pogonatum proliferum (Mitt.) Jaeg—On *Ficus elastica,* Chardura; July, 1935 (350).

Pogonatum papillosulum(Griff.) Mitt.—Chingku, Naga Hills, 2,600 m.; November to December 1933 (60). Shillong, 1,400 m.; September 1934 (170, 181, 197). 181, 197).

Pogonotum microstomum (R. Br.) Brid.—Dozeppe, Naga Hills; August 1935 (295).

EXPLANATION OF PLATE.

1. *Brothera capillifolia.* a, deciduous leaf, ×5.
2. *Syrrhopodon pilulifer.* a, leaf, ×20.
3. *Pseudosymblepharis pallidens.* a, leaf, ×20, b, peristome, ×20.
4. *Ptychomitrium rhacomitrioides.* a, basal areolation, ×40.
5. *Macromitrium Rigbyanum.* a, capsule, ×3.
6. *Jaegerinopsis intergrifolia.* a plant, ×1. b, leaf, ×10.
7. *Symphysodontella Borii.* a, leaf, ×10.
8. *Symphysodontella pilifolia.* a, leaf, ×10.
9. *Symphysodontella tortifolia.* a, stem leaf, ×10. b, leaf apex, ×20.
10. *Pterobryopsis auriculata.* a, leaf, ×10.
11. *Lindigia asiatica.* a, plant, ×1. b, leaf, ×10.
12. *Handeliobryum assamicum.* a, leaf, ×10.
13. *Daltonia perlaxiretis.* a, leaf, ×10. b, upper marginal cells, ×100.
14. *Daltonia gemmipara.* a, leaf, ×10. b, gemmae, ×10.
15. *Ortholimnobium Borii.* a, plant, ×1. b, leaf, ×10. c, capsule, ×12.
16. *Leiodontium complanatum.* a, plant, ×2. b, leaves, ×20. c, alar cells, ×80. d, capsule, ×12.
17. *Aptychella Borii.* a, leaf, ×10.
18. *Hageniella isopterygioides.* a, leaf, ×20. b, alar cells, ×80.
19. *Hageniella assamica.* a, leaf, ×20.
20. *Acanthocladium baculiferum.* a, part of stem, ×1. b, leaf, ×10.

SOME DATA ON THE FAUNA: BLATTODEA, MANTODEA, PHASMODEA AND ORTHOPTERA OF NORTH AFGHANISTAN.

BY

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(*With 6 text-figures*).

The present paper is the result of a study of the collections made in North Afghanistan by N. N. Umnov in 1930 and by V. A. Maximov in the years 1930-31.

The records of *Blattodea, Mantodea* and *Orthoptera* of Afghanistan, up to the present time published by several authors, have been included into the paper in order to elucidate the fauna of the country which is still very little studied.

The present list comprises: 6 *Blattodea*; 10 *Mantodea*; 1 *Phasmodea* and 57 *Orthoptera*, the last order containing: 3 *Tettigonioidea* 6 *Gryllodea* and 48 *Acridodea*. As compared with what was known from literature, our knowledge is now more complete. Several species are recorded for the first time, namely: 2 *Blattodea*, 4 *Mantodea*, 1 *Phasmodea* and 36 *Orthoptera* (3 *Tettigonioidea*, 4 *Gryllodea*, 29 *Acridodea*. Among the members of the last suborder five species new to science have been found.

The holotypes and allotypes of these new species are preserved at the Zoological Institute of the Academy of Sciences, Leningrad.

The author feels it his pleasant duty to express his sincere thanks to Dr. B. P. Uvarov, who kindly sent me for study valuable material and for his kind assistance in the preparation of my paper; to Dr. E. F. Miram, curator of *Orthoptera* in the Zoological Institute of the Academy of Sciences in Leningrad, for her permission to examine the small but very interesting collection of N. N. Umnov; to Dr. S. A. Predtetshensky, senior entomologist of the Institute for Plant Protection in Leningrad for his valuable directions and for the communication of his unpublished records; to Mr. V. A. Maximov, who has kindly placed at the author's disposal his collection.

BLATTODEA

***1. Polyphaga saussurei** (Dohrn), 1888.[1]
Gurimar, 19-8-1930, 1 ♂, 2 ♀♀, 4 larvae (Maximov).

2. Polyphaga camelorum Kirby, 1903.
Kirby (1889) has recorded this species from Hari-Rud valley under the name *Polyphaga sp.* and Chopard (1929) has recorded it from Badghis.

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[1] Species marked with a small asterisk are recorded from Afghanistan for the first time.

3. Polyphaga obscura Chopard, 1929.
This species has been described by Chopard (1929) from Paghman near Kabul.

4. Anisogamia tamerlana Saussure, 1893.
Recorded from Afghanistan by Brancsik (1897).

5. Heterogamodes roseni (Brancsik), 1897.
This species has been described by Brancisk (1897) from Afghanistan, without exact indication of locality, under the name *Heterogamia roseni* Branc.

***6. Phyllodromica irinae** (Bey-Bienko), 1932.
Ak-Tepe, 27-7-1931. 1 ♀ (Maximov).

MANTODEA

7. Eremiaphila arabica Saussure, 1871.
Kirby (1894) has recorded this species from between Khusan and Quetta.

***8. Armene pusilla** (Eversmann), 1854.
Gurimar, 19-8-1930, 1 ♀ (Maximov).

9. Hierodula transcaucasica Brunner von Wattenwyl, 1878.
Gurimar, 19-8-1930, 1 ♀ (Maximov).
Recorded by Kirby (1889) from Afghanistan under the name *Hierodula robusta* Saussure?

10. Mantis religiosa (Linnaeus), 1758.
Kirby (189) has recorded this species from Afghanistan, without exact indication of locality.

***11. Oxythespis wagneri** (Kittary), 1849.
Kazan, 14-8-1930, 1 ♂, 2 ♀♀ (Maximov).

***12. Iris oratoria polystictica** (Fischer de Waldheim), 1846.
Ak-Tepe, 17-71931, 3 ♂♂, 1 ♀ (Maximov).

13. Iris splendida Uvarov, 1922
This species has been described by Uvarov (1922) from Afghanistan, without exact indication of locality.

14. Rivetina baetica (Rambur), 1839.
Gurimar, 19-8-1930, 1 ♂, 2 ♀♀; Ak-Tepe, 27-7-1931, 5 ♂♂ (Maximov).
Kirby (189) has recorded this species from Hari-Rud valley under the name *Polyspilota striata* Stoll, while Jacobson and Bianchi (1902-1905) put it under the name *Polyspilota æruginosa* Goeze.

***15. Empusa pennicornis** (Pallas), 1773.
Man-guzar, 16-8-1930, 3 ♀♀; Ak-Tepe, 27-7-1931, 1 ♂ (Maximov).

16. Blepharopsis mendica nuda Giglio-Tos, 1917.
Kirby (1889) has recorded this species from Afghanistan, without exact indication of locality, under the name *Belpharis mendica* Fabricius.

PHASMODEA

17. Gratidia adelungi Brunner von Wattenwyl, 1908.
Kazan, 11-8-1930, 1 ♀ (Maximov).
♀ (nova). Body large, nearly smooth.

Head elongated, with indistinct longitudinal keels, with two very distinct acute projections between eyes; median keel distinct, reaching to the occiput. Occiput with two tubercles. Eyes round. Antennae moderately thick, 17 jointed, a little longer than head and pronotum together.

Pronotum anteriorly feebly constricted, short, its length nearly 1.5 times as long as maximum width; its surface with distinct longitudinal folds, behind the middle with distinct transverse depression. Mesonotum long, anteriorly somewhat narrowed. Metanotum considerably shorter than mesonotum, parallel-sided. Mesonotum and metanotum with distinct median keel, their surface finely and very densely punctured, with sparse granulae.

Sternum finely and densely punctured, with indistinct granulae. Abdomen with distinct median keel, finely and densely punctured and with indistinct granulae, on each side with indistinct lateral keels. Apex of the subgenital plate shortly-triangular.

General coloration brownish-white.

—	♀
Length of the body ...	89·5 mm.
,, of the antennæ ...	9·5 ,,
,, of the pronotum ...	2·9 ,,
,, of the mesonotum ...	17·5 ,,
,, of the metanotum ...	14·3 ,,
,, of the anterior femora ...	17·5 ,,
,, of the middle femora ...	17·5 ,,
,, of the hind femora ...	24·0 ,,

ORTHOPTERA

Tettigonioidea

*18. **Conocephalus buxtoni** Chopard, 1921.
Mouth of the river Kunduz-Daria, 29-7-1931, 2 ♂♂, 1 ♀ (Maximov).

*19. **Metrioptera tamerlana** (Saussure), 1874.
Mouth of the river Kunduz-Daria, 29-7-1931, 9 ♂♂, 7 ♀♀ (Maximov).

*20. **Decticus albifrons** (Fabricius), 1775.
Ak-Tepe, 27, vii., ♂♂, 5 ♀♀; Mouth of the river Kunduz-Daria, 29-7-1931, 1 ♀ (Maximov).

Gryllodea

21. **Gryllotalpa africana** (P. Beauvois), 1805.
Kirby (1889) has recorded this species from Hari-Rud valley under the name *Acheta africana* P. Beauv.

22. **Gryllus bimaculatus** (De Geer), 1773.
Ak-Tepe 27-7-1931, 2 ♀♀ (Maximov).
Kirby (1889) has recorded probably this species from between Khusan and Quetta under the name *Gryllus capensis* Fabr.

*23. **Gryllulus tartarus** (Saussure), 1874.
Mouth of the river Kunduz-Daria, 29-7-1931, 11 ♂♂ 13 ♀♀ (Maximov).

*24. **Gryllulus chinensis** (Weber), 1801.
Ak-Tepe, 27-7-1931, 3 ♂♂, 1 ♀ (Maximov).

*25. **Gryllulus bucharicus** (Bey-Bienko), 1933.
Mouth of the river Kunduz-Daria, 29-7-1931, 2 ♂♂, (Maximov).

*26. **Pteronemobius heydenii concolor** (Walker), 1871.
Mouth of the river Kunduz-Daria, 29-7-1931, 1 ♂, 4 ♀♀ (Maximov).

Acridodea

27. **Acrida deserti** Uvarov, 1916.
Man-Guzar, 16-8-1930, 7 ♂♂, 4 ♀♀; Ak-Tepe, 27-7-1931, 5 ♂♂, 1 ♀ (Maximov).
Tarbinsky (1926) has recorded this insect for Mazar-i-Sherif under the name *Acrida turrita deserti* Uvarov, but Miram (1935) regards it as a good species.

28. **Acridella nasuta** (Linnaeus), 1758.
Man-Guzar, 16-8-1930, 2 ♂♂, 1 ♀ (Maximov).
Probably this species has been recorded by Kirby (1889), under the name *Acrida grandis* Klug? from between Khusan and Quetta.

*29. **Gonista sagitta** (Uvarov), 1912.
Mouth of the river Kunduz-Daria, 29-7-1931, 1 ♀ (Maximov).

*30. **Platypterna mistshenkoi** Bey-Bienko, 1936.
Kazan, 11-8-1930, 2 ♂♂, 1 ♀ (Maximov).

*31. **Duroniella kalmyka** (Adelung), 1906.
Mouth of the river Kunduz-Daria, 29-7-1931, 9 ♂♂, 7 ♀♀ (Maximov).

32. Dociostaurus maroccanus (Thunberg), 1815.
Kazan, 11-8-1930, 1 ♂, 3 ♀♀; Ak-Tepe, 27-7-1931, 7 ♂♂, 3 ♀♀ (Maximov).
Kirby (1889) has recorded this species from Badghis, under the name *Stauronotus maroccanus* Thunb.

*33. **Dociostaurus tartarus** (Stshelkanovtzev), 1909.
Guriamar, 19-81930, 1 ♂, 1 ♀; Ak-Tepe, 27-7-1931, 1 ♂, 6 ♀♀ (Maximov).

*34. **Notostaurus albicornis albicornis** (Eversmann), 1847.
Kara-bel, 28-6-1930, 2 ♂♂ (Umnov); Gurimar, 19-8-1930, 1 ♂ (Maximov).
All species belong to the typical race but are characterized by smaller dimensions of the body:

	♂♂
Length of the body	10·5—12·8 mm.
,, of the pronotum	2·2— 2·7 ,,
,, of the elytra	5·9— 7·1 ,,
,, of the hind femora ...	7·1— 8·3 ,,
,, of the hind tibiæ	5·9— 7·1 ,,

*35. **Mizonocara uvarovi** Bey Bienko, 1933.
Ak-Tepe, 27-7-1931, 1 ♂ (Maximov).

*36 **Aiolopus affinis** (T. Bolivar), 1902.
Mouth of the river Kunduz-Daria, 29-7-1931, 4 ♂♂, 2 ♀♀ (Maximov).

37. Aiolopus thalassinus (Fabricius), 1781.
Mouth of the river Kunduz-Daria, 29-7-1931, 17 ♂♂, 7 ♀♀ (Maximov).
Redtenbacher (1900) has recorded this species from Afghanistan, without exact indication of locality, under the name *Epacromia tergestina* Charp.

*38. **Aiolopus oxianus** Uvarov, 1926.
Mouth of the river Kunduz-Daria, 29-7-1931, 5 ♂♂, 1 ♀ (Maximov).

39. Locusta migratoria migratoria (Linnaeus), 1758, **ph. solitaria.**
Mouth of the river Kunduz-Daria, 29-7-1931, 6 ♂♂, 7 ♀♀, 3lv, 3liv (Maximov).
Kirby (1889) has recorded this species from Afghanistan (from between Khusan and Quetta) under the name *Locusta danica* Linn.

*40. **Œdaleus senegalensis** (Krauss), 1877.
Man-Guzar, 16-8-1930, 3 ♂♂, 4 ♀♀ (Maximov).

*41. **Mioscirtus wagneri** (Eversmann), 1859.
1859. *Œdipoda wagneri* Eversmann, *Bull. Soc. Imp. Nat. Mosc.*, vol. xxxii. No. 1, pp. 145-6, pl. I, fig. 3 [Type ♀; steppe between Volga and Ural]
1884. *S[cintharista] wagneri* Saussure, Mem. Soc. Phys. Hist. Nat. Gen., vol. xxxviii. No. 9, pp. 121-2, no. 3.
188. *C[onozoa] rogenhoferi* Saussure, Mem. Soc. Phys. Hist. Nat. Gen., vol. xxx. No. 1, pp. 60-61, no. 5, fig. 4 [type ♀; Baghdad].
1896. *Mioscirtus varentzzowi*, Zubowsky, Hor. Soc. Ent. Ross, vol. xxx. pp. 186-7, no. 12, [type ♀; Kopet-Dagh. Firjuza].
1922. *Mioscirtus wagneri rogenhoferi* Uvarov, *Journ. Bom. Nat. His. Soc.* vol. xxxiii. No. 3, p. 361, no. 29.
Man-Guzar, 16-8-1930, 14, ♂♂, 15 ♀♀ (Maximov).

The above synonymy has been established by S. A. Predtetshensky in his as yet unpublished work on *Acridodea* of Badghis.

The comparative dimensions of the Afghan and the Lower Volga specimens are given in the following table:

	Afghan specimens		L. Volga specimens (after Predtetshensky)	
	♂♂	♀♀	♂♂	♀♀
Length of the body	14·5–15·0 mm	22·5–28·5 mm	12·0–16·0 mm	17·0–25·0 mm
,, of the pronotum	3·1– 3·2 ,,	4·4– 5·9 ,,	2·6– 3·2 ,,	3·7– 5·0 ,,
,, of the elytra	13·5–17·0 ,,	21·0–28·0 ,,	11·4–15·1 ,,	16·8–22·0 ,,
,, of the hind femora	8·8– 9·6 ,,	11·8–15·4 ,,	7·8– 9·0 ,,	10·5–12·8 ,,
,, of the hind tibiæ.	8·0– 8 8 ,,	11·0–14·6 ,,	...	...

***42. Acrotylus insubricus** (Scopoli), 1786.
Mouth of the river Kunduz-Daria, 29-7-1931, 3 ♂♂ (Maximov).

***43. Sphingonotus savignyi** Saussure, 1884.
Kazan, 11-8-1930, 2 ♀♀ (Maximov).

44. Sphingonotus afghanicus Mistshenko, 1936.
This species has been described by Mistshenko (1936) from Barazendan.

***45. Sphingonotus nebulosus discolor** Uvarov, 1933.
Ak-Tepe, 27-7-1931, 2 ♂♂, 1 ♀ (Maximov).

46. Sphingonotus longipennis Saussure, 1884.
Recorded from Afghanistan (Parachinor, Kuran) by Uvarov (1925).

***47. Sphingonotus obscuratus brunneri** Saussure, 1884.
Ak-Tepe, 27-7-1931, 1 ♂, 1 ♀ (Maximov).

48. Sphingonotus octofasciatus (Serville), 1839.
Recorded from Afghanistan by *Kirby* (1889) under the name *Spingonotus kittaryi* Saussure?, without exact indication of locality.

***49. Helioscirtus moseri moseri** Saussure, 1884.
Ak-Tepe, 27-7-1931, 3 ♂♂, 1 ♀ (Maximov).

***50. Leptopternis gracilis** (Eversmann), 1847.
Kazan, 11-8-1930, 5 ♂♂, 2 ♀♀ (Maximov).

51. Hyalorrhipis turcmena Uvarov, 1926.
Kazan, 11-8-1930, 2 ♀♀ (Maximov).
Jacobson and Bianchi (1902-5) recorded from Afghanistan also *Hyalorrhipis clausi* Kittary, Dr. Aitchison being referred to as collector, but there is no such record in Kirby's report (1889) on his collection and Dr. B. P. Uvarov informs me that there are no specimens in Aitchison's material in the British Museum.

52. Iranella eremiaphila Uvarov, 1922.
Recorded by *Uvarov* (1933) from Afghanistan, without exact indication of locality.

53. Strumiger desertorum persa Uvarov, 1933.
Kazan, 11-8-1930, 1 ♀ (Maximov).
A species recorded by *Kirby* (1889) with a mark of interrogation from Hari-Rud valley, under the name *Thrinchus campanulatus* F.-W. is a species of *Thrinchus* in poor condition and cannot be determined according to Dr. B. P. Uvarov who has examined it.

54. Eremocharis afghana Ramme, 1928.
This species has been described by Ramme (1928) from Kabul.

55. Tropidauchen sp. n.

Recorded by Kirby (1889) from Badghis and the Hari-Rud valley under the name *Eunapius granosus* Stål, and Uvarov (1922) put it under the name *Tropidauchen cultricolle* Saussure, while actually it represents an undescribed species as I am able to tell after the examination of the specimens kindly sent to me by Dr. B. P. Uvarov.

***56. Tropidauchen uvarovi** sp. n. (Figs. 1 U and 2 U).

♀ (holotype). Body strongly rugulose.

Head very rough with sharp granulae, in the posterior part rugulose. Eyes shortly-oval, feebly prominent sidewards; vertical diameter of the eye a little larger than its horizontal diameter and nearly half the length of the interocular space. Face vertical. Frontal ridge very narrow, strongly depressed, under the median ocellum constricted, at the clypeus triangularly expanded and somewhat obliterated; seen in profile wavy, strongly prominent at the antennal bases; its margins thick. Vertex broad, octagonal, strongly depressed, granular, with two very sharp small tubercles at the middle; median keel in the posterior part sharp; its margins sharp and straight. Antennae thick, 15-jointed, far from reaching the posterior margin of the pronotum.

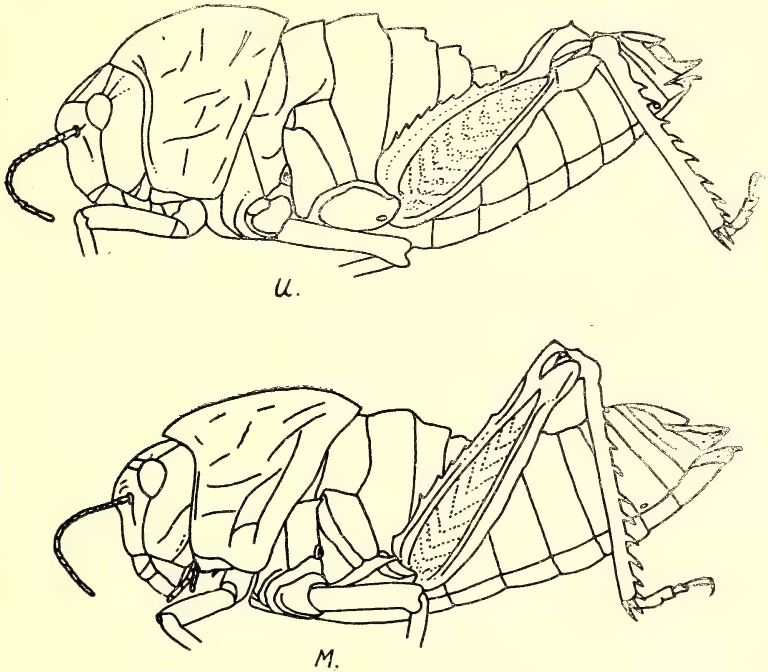

Fig.—1 U. *Tropidauchen uvarovi*, sp. n., type, ♀, xl. 8.

M. *T. miramae*, sp. n., type, ♀, ×18.

Pronotum strongly rugulose with very sharp granulae at the middle; on each side of the median keel with two oblique and very sharp granular holes; seen in profile feebly arched, at the posterior margin slightly excised: posterior angle obtuse, at the middle excised. Lateral lobes of the pronotum strongly rugulose and granular, with three indistinct transverse sulci; anterior margin a little wavy, anterior lower angle obtuse, feebly rounded; posterior margin strongly sinuous, oblique; posterior lower angle obtuse, feebly rounded; lower margin obliquely ascending, wavy.

Mesonotum and metanotum strongly rugulose and granular, with a median keel.

Sternum sparsely and finely punctured; its length almost 1.5 times as long as maximum width; interspace between lobes of the mesosternum about 1.5 times as wide as long. Processus of the prosternum wedge-shaped, excised in front.

Hind femur sharply-granular, its length 2.9 times as long as maximum width; upper margin with 8 sharp teeth and 1-2 small teeth between them; lower margin smooth, strongly wavy. Hind tibia a little shorter than the hind femur, with 9 spines on the outer and 8 spines on the inner side.

Abdomen with a sharp median keel, seen in profile forming rectangular teeth on the first segments of the abdomen and with triangularly-blunted teeth on the posterior margin of each other segment. Valvae of the ovipositor with blunted points; lower valvae with one large and several small teeth on the outer margin. Posterior margin of the subgenital plate rounded, prominent.

General coloration grayish-whitish. Apical part of the antennae brownish. Tibiae of the front and middle legs orange-reddish. Hind femora yellow inside; lower margin yellow; middle of the apex black both outside and inside. Hind tibiae red inside, yellow-orange outside; spines yellow with black apex; tarsi red inside, orange outside.

♂ (allotype.) Like the female, but considerably smaller. Vertical diameter of the eye equals to two-thirds the interocular space. Interspace between lobes of the mesosternum 1.25 times as wide as long. Hind tibiae with 9 spines on both sides.

Coloration like the female.

	holotype ♀	allotype ♂	paratypes ♀♀	paratypes ♂♂
Length of the body ...	52·5 mm	35·6 mm	53·5–67·5mm	29·8-36·5mm
,, of the pronotum ...	14·4 ,,	9·7 ,,	13·5–15·8 ,,	8·2– 9·2 ,,
,, of the hind femora .	20·0 ,,	15·0 ,,	20·0–22·5 ,,	13·0–14·8 ,,
,, of the hind tibiæ ...	19·0 ,,	14·0 ,,	19·0–21·5 ,,	12·0–13·8 ,,

Patria. North Afghanistan: settl. Norbeck, 16-22 vi, 3 ♀♀ (including the holotype), 2 ♂♂; valley Ailjak, 26-6-1930, 1 ♀, 2 ♂♂ (Umnov); Abdan, 26-8-1930, 2 ♂♂ (Maximov).

This new species is near to *Tropidauchen cultricolle* Saussure (1881), described by that author from Ashkhabad (Turkmenistan), but differs from it by the following characters:

Tropidauchen uvarovi sp. n.	**Tropidauchen cultricolle** Saussure.
♀, ♂. Vertex very broad, octagonal.	♀, ♂. Vertex broad, oval.
Antennae 14-15-jointed.	Antennae 17-jointed.
Pronotum slightly covering the head, not reaching the vertex.	Pronotum strongly covering the head, reaching to the vertex.
Hind tibiae red inside.	Hind tibiae blue inside.

This species the author dedicates with profound respect to Dr. B. P. Uvarov. one of the best specialists in *Orthoptera.*

***57. Tropidauchen miramæ** sp. n. (Figs. 1 M and 2 M).

♀ (Holotype). Body somewhat rough.

Head in the posterior part slightly rugulose, sparsely punctured, nearly smooth. Eyes shortly-oval, slightly prominent sidewards; vertical diameter of the eye a little larger than the horizontal diameter and equals to two-thirds of the interocular space. Face vertical. Frontal ridge narrow, strongly depressed, nearly parallel-sided, triangularly-divergent at the clypeus and somewhat obliterated; seen in profile wavy, strongly prominent at the antennal bases; its margins thick. Vertex narrow, long, oval, strongly depressed, granular; median keel in the posterior part of the vertex distinct. Antennae thick, 18-jointed, not reaching the posterior margin of the pronotum.

Pronotum slightly rugulose, but sharply granular at the middle; on each side of the median keel with two oblique sharply-granular folds; seen in profile feebly arched, somewhat wavy; posterior angle obtuse, at the middle excised. Lateral lobes of the pronotum slightly rugulose, but sharply granular, with three indistinct transverse sulci, at the middle with a longitudinal smooth fold; anterior margin wavy, vertical, anterior lower angle obtuse, feebly rounded; posterior margin wavy, oblique, posterior lower angle obtuse, rounded; lower margin obliquely ascending, wavy.

Mesonotum and metanotum slightly rugulose and sharply granular, with a median keel.

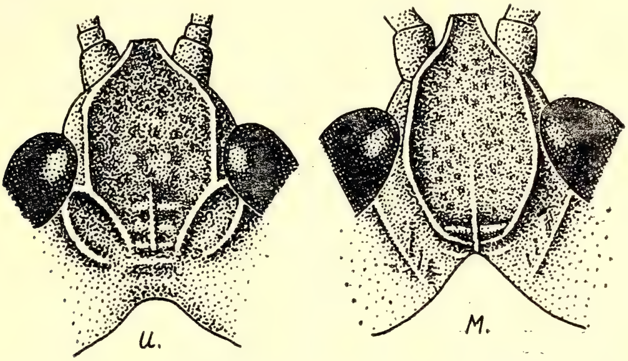

Fig. 2.—U. *Tropidauchen uvarovi,* sp. n., allotype, ♂, vertex.—M. *T. miramae,* sp. n., allotype, ♂.

Sternum sparsely and finely punctured; its length nearly 1.5 times as long as maximum width; interspace between lobes of the mesosternum scarcely wider than long. Processus of the prosternum narrow, wedge-shaped; its apex feebly excised.

Hind femur smooth, its length 3.3 times as long as maximum width; upper margin with 9 small teeth; lower margin smooth, wavy. Hind tibia a little shorter than hind femur, with 9 spines on both sides.

Abdomen with a sharp median keel, seen in profile forming small triangularly-blunted teeth at the postreior margin of each segment. Valvae of the ovipositor with blunted points. Lower valvae of the ovipositor with a sharp projection on the outer margin. Posterior margin of the subgenital plate feebly triangularly-prominent.

General coloration brownish-olive. Head whitish. Apical part of the antennae brown. Margins of the pronotum and of its lateral lobes and longitudinal fold of the lobes, whitish. Abdomen below yellowish-white. Hind femur inside yellow; its lower margin and upper margin inside black-blue; middle of apex outside and inside, black. Hind tibiae yellow (in some paratypes violet-rosy); spines yellow with black apex.

♂ (allotype). Like the female, but considerably smaller. Antennae reaching the posterior margin of the pronotum.

Coloration like the female.

	holotype ♀	allotype ♂	paratypes ♀♀	paratypes ♂♂
Length of the body ...	50·5mm	35·6mm	55·5–71·5mm	28·5–36·0mm
,, of the pronotum ...	15·8 ,,	10·5 ,,	16·5–17·2 ,,	9·2–11·0 ,,
,, of the hind femora .	21·7 ,,	16·5 ,,	22·5–24·0 ,,	15·5–16·8 ,,
,, of the hind tibiæ ...	20·7 ,,	15·5 ,,	21·5–23·0 ,,	14·5–15·8 ,,

Patria. North Afghanistan: pass Irghailyk, 14. vi. 1 ♀, 2 ♂♂; settl. Morbek. 16-25. vi, 4 ♀♀ (including the holotype), 2 ♂♂; Mazar-i-Sherif: 24. vi, 1 ♂; valley Ailjak, 26-6-1930, 2 ♂♂ (Umnov); pass Ab-dugh, 28-8-1930, 1 ♀ (Maximov).

This new species is near to *Tropidauchen paramonovi* Dirsh (1927), described by that author from Firuza (Kopet-Dagh, Turkmenistan), but differs from it by the following characters:

Tropidauchen miramae sp. n.	**Tropidauchen paramonovi** Dirsh.
♀, ♂. Body more slender.	♀, ♂. Body more robust.
Vertex more narrowed.	Vertex more broadened.
Pronotum sharply granular.	Pronotum feebly granular.
Processus of the prosternum narrow.	Processus of the prosternum broad.
Hind femur slender; its length 3.3 times its maximum width.	Hind femur robust; its length 2.9 times its maximum width.

This species the author dedicates to Dr. Emilia F. Miram, curator of Orthoptera in the Zoological Institute of the Academy of Sciences, Leningrad, in acknowledgment of her assistance in the work.

58. Chrotogonus homalodemus (Blanchard), 1836.

This species has been recorded by Kirby (1889) with a question mark from between Khusan and Quetta.

59. Pyrgomorpha conica (Olivier), 1791.

Gurimar, 9-7-1930, 1 ♂, 1 ♀ (Umnov); Mouth of the river Kunduz-Daria, 29-7-1931, 1 ♂, 2 ♀♀ (Maximov).

Kirby (1889) has recorded apparently this species from Badghis, as *Pyrgomorpha bispinosa* Walscer.

***60. Derycoris albidula** (Serville), 1839.

Man-Guzar, 16-8-1930, 2 ♂♂, 2 ♀♀ (Maximov).

***61. Oxya fuscovittata** (Marschall), 1835.

Mouth of the river Kunduz-Daria, 29-7-1931, 8 ♂♂, 20 ♀♀, 17 larvae (Maximov).

***62. Diexis gussakovskyi** Miram (in litt.).

Kazan, 11-7-1930, 1 ♀ (Maximov).

63. Conophyma predtetshenskyi sp. n. (Figs. 3A, B, C, D and E).

♂ (holotype). Body of medium size, robust and smooth.

Head not elevated above the level of the pronotum, very sparsely and finely punctured. Eyes nearly round, small, slightly prominent sidewards; vertical diameter of the eye equal to interocular space. Face sloping. Frontal ridge scarcely depressed, smooth, nearly parallel-sided, not reaching the clypeus; seen in profile feebly prominent at the antennal bases; its margins scarcely distinct. Fastigium of the vertex strongly sloping, almost vertical, vertex scarcely depressed, very finely and densely punctured; its margins scarcely distinct; median keel very weak; maximum width of the vertex about two times that of frontal ridge between antennae. Temporal foveolae indistinct. Occiput slightly sloping, finely and densely punctured. Antennae thin, 19-20-jointed, considerably longer than head and pronotum together.

Pronotum in prozona nearly smooth, with three transverse sulci; two anterior sulci shallow, not intersecting the median keel; median keel sharp and intersected only by the third, deep transverse sulcus; lateral keels interrupted and form double set of keels on each side; first keels reach only the first transverse sulcus, convergent; second keels begin on the lateral lobes near the first transverse sulcus and gradually ascending reach the second transverse sulcus, within this area second keels are parallel to the first keels, while further passing along the margin of the pronotum they become parallel to the median keel, reaching to the third transverse sulcus; metazona very short, densely punctured, with hardly marked median keels, its length about one-third that of the prozona; posterior margin straight, very feebly triangularly-excised at the middle. Lateral lobes of the pronotum trapezoidal, somewhat narrowed towards the lower margin, with three transverse sulci, feebly punctured, anterior and posterior margins undulating; lower margin strongly wavy, obliquely-ascending; anterior lower angle obtuse, rounded; posterior lower angle 90°, broadly-rounded.

Mesonotum and metanotum smooth; metanotum with a distinct median and lateral keels.

Sternum sparsely and coarsely punctured, its maximum width almost equal to length; interspace between lobes of the mesosternum about 1.5 times as wide as long.

Front and middle femora somewhat swollen. Hind femur thick; its length 3.3 times its maximum width. Hind tibia a little shorter than hind femur, with 9 spines on the outer and 8-9 spines on the inner side.

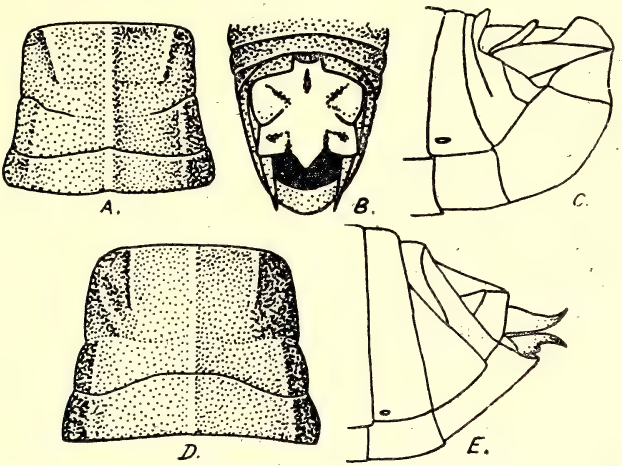

Fig. 3.—*Conophyma predtetshenskyi Sp. n.*

A. Dorsal view of the pronotum of type ♂; B. Dorsal view of the anal plate of type ♂; C. Lateral view of the apex of abdomen of type ♂; D. Dorsal view of the pronotum of allotype ♀; E. Lateral view of the apex of abdomen of allotype ♀; ×7.5.

Abdomen, seen from above, with a median keel; lobes of the last abdominal tergite broad and short, widely separated. Anal plate nearly square, apical part slightly narrowed, posterior angles rounded, posteror margin with a large triangular projection at the middle; its surface at the median longitudinal sulcus convex and with a very sharp triangular projection at each posterior angle. Cercus straight, strongly conical, pointed at the apex; its length about 1.75 times the length of the anal plate.

Head, pronotum and abdomen, seen from above nearly black. Antennae, front and middle legs, hind femora, sternum, head and abdomen, seen from below—dirty-yellow. Hind tibiae orange.

♀ (allotype). Like the male, somewhat larger. Vertical diameter of the eye somewhat less than the interocular space. Frontal ridge obliterate at the clypeus, more depressed than in the male. Vertex with distinct median keel, more depressed than in the male and with distinct elevated margins. Front and middle femora slightly swollen. Hind tibia with 8-9 spines on the outer and on the inner side. Upper and lower valvae of the ovipositor with acute points and a distinct projection on the outer margin. Subgenital plate considerably longer than wide; its posterior angles broadly-rounded; posterior margin with a rather long narrow triangular sharply pointed projection at the middle.

Coloration like the male. Head, pronotum and abdomen, seen from above, dark brownish with black spots.

	holotype ♂	allotype ♀	paratypes ♂♂	paratypes ♀♀
Length of the body.	14·2 mm	16·5 mm	13 0–14·8 mm	15·5–18·5 mm
,, of the pronotum.	2·3 ,,	2·4 ,,	2·1– 2·6 ,,	2·8– 3·1 ,,
,, of the hind femora.	7·5 ,,	7·6 ,,	7·0– 8·0 ,,	8·2– 9·0 ,,
,, of the hind tibiæ.	6·5 ,,	6·6 ,,	6·0– 7·0 ,,	7·2– 8·0 ,,

Patria. North Afghanistan: Dzhanbulak, 13. vi, 3 ♂♂ (including the holotype), 2 ♀♀; pass Irghailyk, 13. vi, 3 ♂♂, 1 ♀; settl. Norbek, 22. vi, 2 ♂♂; Mazar-i-Sherif, 24-6-1930, 1 ♂, 1 ♀ (Umnov); pass Ab-dugh, 20-8-1930, 1 ♂, 3 ♂♂ (Maximov).

This species is near to *Conophyma ikonnikovi* Uvarov (1925), described by that author from Southern Bokhara (at present Tadjikistan), but differs from it by the following characters:

Conophyma predtetshenskyi sp. n.	**Conophyma ikonnikovi** Uvarov.
♂. Lobes of the last abdominal tergite widely separated.	♂. Lobes of the last abdominal tergite very feebly separated, almost contiguous.
Anal plate nearly square, slightly narrowed to the apex; posterior angles obtuse; its surface at the posterior angles convex, with a sharp triangular projection at each posterior angle.	Anal plate not square, strongly dilated to the apex; posterior angles acute; its surface trough-like, without triangular projection at the posterior angles.
Cerci straight, conical; their length almost 1.75 the length of the anal plate.	Cerci at the bases constricted, in the apical third, from within, swollen, then strongly pointed; their length almost two times the length of the anal plate.

This species the author dedicats to his first teacher Dr. S. A. Predtetshensky.

***64. Conophyma bey-bienkoi** sp. n. (Figs. 4A, B, C, D and E).

♂ (holotype). Body of medium size, robust and smooth.

Head not elevated above the level of the pronotum, smooth. Eyes nearly round, slightly prominent sidewards; vertical diameter of the eye equal to horizontal diameter and nearly equal to interocular space. Face sloping. Frontal ridge slightly depressed, under the median ocellum subconstricted, then dilated and nearly reaching the clypeus; seen in profile feebly prominent at the antennal bases; its margins thick. Fastigium of the vertex strongly sloping, frontal ridge between antennae. Temporal foveolae indistinct. Occiput feebly elevated; median keel absent; maximum width about two times that of the

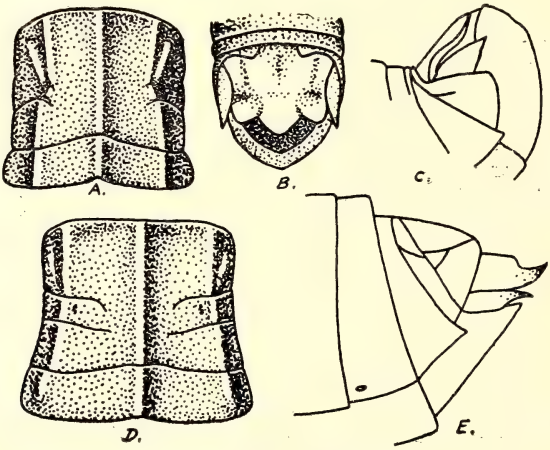

Fig. 4.—*Conophyma bey-bienkoi sp. n.*

A. Dorsal view of the pronotum of type ♂; B. Dorsal view of the anal plate of type ♂; C. Lateral view of the apex of abdomen of type ♂; D. Dorsal view of the pronotum of allotype ♀; E. Lateral view of the paex of abdomen of allotype ♀; ×7·5.

frontal ridge between antennae. Temporal foveolae indistinct. Occiput feebly sloping, punctured. Antennae thin, 19-jointed, somewhat longer than head and pronotum together.

Pronotum smooth in the prozona; lateral keels distinct, feebly concave; metazona punctured, its length one-third that of the prozona; median keel in the prozona sharp, intersecting first transverse sulcus, in the metazona indistinct; posterior margin straight very feebly excised in the middle. Lateral lobes of the pronotum trapezoidal, narrowed towards the lower margin, in the posterior part punctured, with three transverse sulci; interspaces between first and second, as well as second and third transverse sulci at the lateral keels of the pronotum slightly rough; anterior and posterior margins undulating; lower margin strongly wavy, obliquely-ascending; anterior lower angle obtuse, rounded; posterior lower angle a little larger than 90°, broadly-rounded.

Mesonotum and metanotum smooth; metanotum with a distinct median and lateral keels.

Sternum very sparsely punctured; its maximum width equal to its length; interspace between lobes of the mesosternum 1.25 times as wide as long.

Front and middle femora swollen. Hind femur thick; its length 3.3 times the maximum width. Hind tibia a little shorter than hind femur, with 9 spines on both sides.

Abdomen, seen from above, with a median keel; lobes of the last abdominal tergite short, broad, widely separated. Anal plate nearly square; lateral margins somewhat excised; posterior angles very sharp, rounded; posterior margin somewhat excised, with a slight triangular projection at the middle; its surface at the middle convex. Cerci conical, pointed at the apex, straight, a little longer than the anal plate.

Head, pronotum and abdomen, seen from above, brownish-blackish with brown spots. Antennae, front and middle legs, hind femora, sternum, head and abdomen, seen from below, tawny. Apical part of the hind tibiae and basal part of the hind femora from within orange-reddish.

♀ (allotype). Like the male, but larger. Subgenital plate considerably longer than wide, posterior angles broadly-rounded, posterior margin with a rather long triangular projection at the middle. Upper and lower valvae of the ovipositor with acute points and projection on the outer margin. Coloration like the male.

	holotype ♂	allotype ♀	paratypes ♂♂	paratypes ♀♀
Length of the body ...	13·0mm.	15·5mm	12·8–14·0mm	16·5–19·8mm
,, of the pronotum ...	2·3 ,,	2·9 ,,	2·1–2·4 ,,	3·6– 3·9 ,,
,, of the hind femora .	7·5 ,,	8·2 ,,	6·5–7·8 ,,	8·5– 9·0 ,,
,, of the hind tibiæ ...	6·5 ,,	7·2 ,,	5·5–6·8 ,,	7·5– 8·0 ,,

Patria. North Afghanistan: pass Irghailyk, 13. vi, 4 ♂♂, 5 ♀♀; Mabar-i-Sherif, 24. vi, 1 ♂; valley Ailjak, 26-6-1930, 2 ♂♂ (including the holotype), 4 ♀♀ (Umnov); pass Ab-dugh, 20-8-1930, 2 ♂♂ (Maximov).

This species is near to *Conophyma sokolowi* Zubovsky (1898), described by that author from environs Tashkent (Uzbekistan), but differs from it by the following characters:

Conophyma bey-bienkoi sp. n.	**Conophyma sokolowi** Zubovsky.
♂. Median keel of the pronotum slight. Anal plate nearly square; lateral margins excised; posterior angles very sharp, rounded, prominent sidewards; posterior margin excised.	♂. Median keel of the pronotum sharp. Anal plate square; lateral margins straight; posterior angles feebly expressed, broadly rounded, not prominent sidewards; posterior margin convex.

This species the author dedicates to Dr. G. J. Bey-Bienko, the author of numerous valuable and very interesting papers on *Orthoptera*, *Dermaptera* and *Blattodea*.

***65. Conophyma kittaryi** Tarbinsky, 1931 (Figs. 5A and B).

Dzhanbulak, 13. vi., 2 ♂♂; valley Ailjak, 14, vi, 2 ♀♀; settl. Norbek, 22. vi., 5 ♂♂, 1 ♀; Kara-bel, 28-6-1930, 1 ♂ (Umnov); Gurimar, 19-8-1930, 2 ♂♂, 3 ♀♀ (Maximov).

♀ (nova). Body large, robust, smooth.

Head somewhat elevated above the level of the pronotum, smooth. Eyes nearly round, slightly prominent sidewards; vertical diameter equal to horizontal diameter of the eye and nearly equal to interocular space. Face moderately sloping. Frontal ridge slightly depressed at the median ocellum, almost parallel-sided, obliterate at the clypeus; seen in profile flat, not prominent at the antennal bases; its margins thick. Fastigium of the vertex forming an angle of about 45°; vertex broad, not depressed at all, slightly convex; margins scarcely visible; median keel absent; maximum width about 2.25 times that of the frontal ridge between antennae. Temporal foveolae indistinct. Occiput slightly sloping. Antennae thin, not reaching the posterior margin of the pronotum, 20-22 jointed.

Pronotum smooth, feebly convex, punctured, with three weak transverse sulci, only the last sulcus intersecting median keel; median keel distinct; lateral keels slight, but distinct, interrupted and forming double set of keels on each side; first keels somewhat converging and reach only the first transverse sulcus; second keels begin near the first transverse sulcus and are divergent; metazona very short, punctured, its length about one-third that of the prozona; posterior margin straight, indistinctly excised in the middle. Lateral lobes of the pronotum punctured, feebly trapezoidal, somewhat narrowed at the lower margin, with three deep transverse sulci, interspaces between them rough; anterior margin feebly wavy, anterior lower angle obtuse, feebly rounded posterior margin almost straight, posterior lower angle obtuse, broadly-rounded; lower margin slightly obliquely-ascending, at the middle convex.

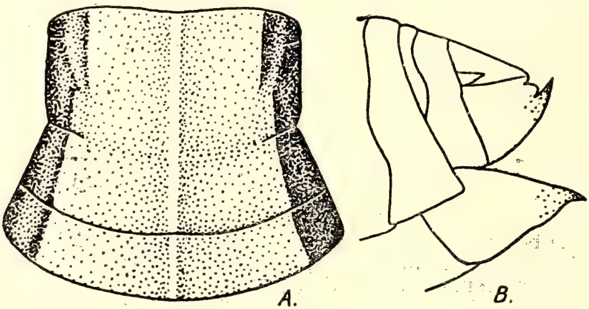

Fig. 5.—*Conophyma kittaryi* Tarbinsky; ♀.

A. Dorsal view of the pronotum.
B. Lateral view of the apex of abdomen; ×7.5.

Mesonotum and metanotum smooth, with a distinct median keel.

Sternum sparsely and finely punctured, its maximum width nearly equal to length; width of interspace between lobes of the mesosternum a little larger than its length.

Front and middle femora feebly swollen. Hind femur short; its length 3.3 times its maximum width. Hind tibia a little shorter than hind femur, with 8-9 spines on the outer and 9-10 spines on the inner side.

Abdomen, seen from above, with a distinct median keel. Subgenital plate nearly square. Valvae of the ovipositor with acute points; lower valvae with a small projection on the outer margin.

General coloration blackish-brown, with two dirty-yellow longitudinal stripes, angularly-inflexed on the pronotum and almost parallel-sided on the abdomen. Lateral lobes of the pronotum in the upper middle black, in the lower middle dirty-yellow. Antennae, head and legs—yellow-brownish. Sternum and abdomen, seen from below—dirty-yellow. Hind femur from within and below yellow, its upper margin with two darkish fasciae. Hind tibiae orange.

	♀♀	♂♂
Length of the body	21·5–23·5 mm	17·5–19·5 mm
,, pronotum ...	4·1– 4·5 ,,	3·3– 4·0 ,,
,, hind femora ...	10·0–10·2 ,,	8·5–10·0 ,,
,, hind tibiæ ...	8.5– 8·7 ,,	7·0– 8·5 ,,

***66. Calliptamus italicus italicus** (Linnaeus), 1758.
Mouth of the river Kunduz-Daria, 29-7-1931, 11 ♂♂, 5 ♀♀ (Maximov).

***67. Calliptamus siculus deserticola** (Vosseler), 1902.
Gurimar, 19-8-1930, 2 ♂♂, 7 ♀♀; Ak-Tepe, 27-7-1931, 8 ♂♂, 5 ♀♀ (Maximov).

***68. Kripa coelesyriensis** (Giglio-Tos), 1893.
Ak-Tepe, 27-7-1931, 3 ♂♂, 1 ♀ (Maximov).

69. Anacridium aegyptium (Linnaeus), 1764.
Recorded by Kirby (1889) from Badghis and Hari-Rud valley, under the name *Acridium aegyptium* (Linnaeus).

***70. Thisoecetrinus pterostichus** (Fischer de Waldheim), 1846.
Mouth of the river Kunduz-Daria, 29-7-1931, 2 ♂♂, 1 ♀ (Maximov).

71. Thisoecetrus littoralis asiaticus Uvarov, 1933.
Kazan, 11-8-1930, 1 ♂ (Maximov).
Recorded by Kirby (1889) from Afghanistan (between Khusan and Quetta), under the name *Euprepocnemis littoralis* (Rambur).

***72. Thisoecetrus adspersus** Redtenbacher, 1889.
Man-Guzar, 16-8-1930, 1 ♂, 4 ♀♀ (Maximov).

73. Kabulia afghana Ramme, 1928.
This species has been described by Ramme (1928) from Kabul.

***74. Gomphomastax morosus** sp. n. (Figs. 6A, B, C and D).
♀ (holotype). Body slender, rugulose.

Head rather large, elevated above the level of the pronotum, strongly rugulose. Eyes irregularly-oval, moderately prominent sidewards; the largest diameter of the eye a little less than the interocular space and 1.5 times the smallest diameter. Face very strongly sloping. Frontal ridge narrow, strongly depressed, almost parallel-sided, at vertex feebly triangularly dilated and reaching to the clypeus; seen in profile wavy, slightly prominent at the antennal bases; margins thin. Vertex convex, strongly rugulose, forming an acute angle with frontal ridge, margins scarcely visible; median keel distinct. Occiput feebly sloping, rugulose, with distinct median keel. Antennae thick and short, 12-jointed, a little longer than the length of the front femora, not reaching the posterior margin of the pronotum.

Pronotum rugulose; median keel slight, but distinct; posterior margin straight, at the median keel feebly triangularly-excised; lateral keels indistinct. Lateral lobes of the pronotum oblong, their length being larger than the height, rugulose; about the middle with a sharp transverse sulcus and distinct keel passed diagonally from the posterior upper angle to the anterior lower angle; anterior margin straight, anterior lower angle somewhat more than 90°, broadly-rounded; posterior margin slightly wavy, posterior lower angle nearly 90°, feebly rounded; lower margin slightly wavy and a little obliquely-ascending.

Mesonotum and metanotum slightly rugulose, with distinct median and lateral keels.

Sternum very finely and densely punctured, nearly square, with rounded angles and a border at the margins; anterior margin prominent; posterior margin triangularly-excised; interspace between lobes of the mesosternum about 3.5 times as long as its length, Arolia between claws of the tarsi small, reaching to the middle of claws.

Abdomen, seen from above, with an indistinct median keel. Valvae of the ovipositor with acute points; outer margin of the upper valvae with some irregular teeth; outer margin of the lower valvae with 4 large teeth. Posterior margin of the subgenital plate with 3 projections; the middle projection is longer, sharply-angular; two lateral projections obtusely rounded.

General coloration yellowish-brown with blackish design. Apical part of the antennae blackish.

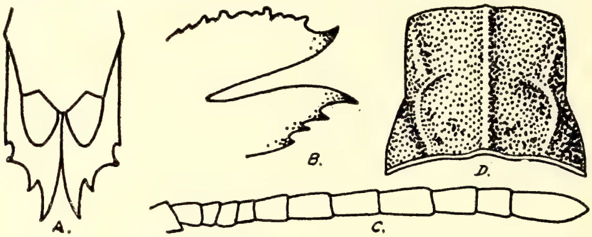

Fig. 6.—*Gomphomastax morosus sp. n.* type ♀.

A. Dorsal view of the subgenital plate; B, Lateral view of the ovipositor. C. Dorsal view of the antenna; D. Dorsal view of the pronotum of allotpye ♂; ×12.5.

♂ (allotype). Like the female, smaller. The largest diameter of the eye a little longer than the interocular space. Antennae thin, considerably longer than head and pronotum together, somewhat thickened at the apex. Hind femur very slender; their length nearly 6 times larger than the maximum width. Hind tibia considerably longer than hind femur, with 22 spines on the outer and 17 spines on the inner side. First joint of the hind tarsus with 4 spines on the outer and 5 spines on the inner margin. Subgenital plate, seen in profile, shortly triangular. Cerci rather long, straight, cylindrical, obtuse, with sparse hairs.

Coloration like the female.

	holotype ♀	allotype ♂
Length of the body ...	20·5 mm.	13·5 mm.
,, of the antennæ ...	4·5 ,,	...
,, of the pronotum ...	1·8 ,,	1·1 ,,
,, of the hind femora ...	...	7·8 ,,
,, of the hind tibiæ ...	...	9·0 ,,

Patria. North Afghanistan: pass *Irghailyk*, 14-6-1930, 1 ♀ (holotype), 1 ♂ (Umnov).

This new species is near to *Gomphomastax opacus* Krauss in Zubovsky (1898a), described by that author from Podgorny and Sasanovka (Kirghizstan), but differs from it by the following characters:

Gomphomastax morosus sp. n.	**Gomphomastax opacus** Krauss.
♀. Antennae thick, 12-jointed.	♀. Antennae thin, 23-25 jointed.
Upper valvae of the ovipositor at apex of the outer margin with distinct large excision.	Upper valvae of the ovipositor at apex of the outer margin without excision.

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THE KODAIKANAL BIRDS AND HOW TO NAME THEM.

BY

EDWARD G. NICHOLS.

Kodaikanal, in the Palni Hills, Madura District, is a good place to study birds. One's first impression is of a great abundance of bird-life in the trees, shrubbery, and open spaces about every house. After a short time, however, one notices that the same kinds of birds are seen again and again. The number of different species is actually not as large as in many places on the plains. This is an advantage for the beginner, since too many different birds seen at once would cause confusion. The reasons for the limited number of species are not far to seek. Firstly, Kodaikanal is too high for many birds. Some species live on the plains and never venture into the hills at all. Some, like the sparrows and crows, are brave enough to climb to about 5,000 ft., but not up to 7,000. Many other birds are found only in the forests between 2,000 and 5,000 ft. The species that prefer the hill-tops, and those that wander up so high, are comparatively few. Secondly, Kodikanal is too far south. Migrants from the north drop off one by one in the more northerly latitudes of India for the winter. Only a few reach 10° 14′ north latitude, where Kodaikanal is located. Thirdly, Kodaikanal has little water, and so there are few water-birds found there. Land-birds, too, would be more numerous if there were more woodland and more farms and gardens in place of the grassy downs which offer little shelter and in which the bird population is fairly scanty.

There are one or two drawbacks to the study of birds at Kodaikanal. One is the height of some of the trees. The blue-gums are so tall that one almost requires a telescope to see birds in them. Curiously, very few birds seem to like blue-gums, but there are many other big trees which tire the neck of the observer. Another hindrance is the density of the foliage in the *sholas* (jungles). This makes it hard to find a bird which moves about much, and one has to record many brief and imperfect observations. On the whole, however, it is a great place for birds, and those who find the difficulties of field-work too great can sit on the verandah and concentrate on a few species.

Purpose. When I first came to Kodaikanal, I longed for some book which would help me to identify the birds I saw. I have now, after seven seasons, named most of the common birds to my own satisfaction, and this paper is an attempt to provide for the beginner the help I myself needed. Of course, I wish it were illustrated, because a picture conveys more than many words. However, I have tried to give pictures, in broad strokes, with a few words. Most descriptions are so full as to confuse the reader. I have perhaps erred on the opposite side, giving only those few markings by which the species found at Kodaikanal can be distinguished from one another quickly and easily. For complete descriptions, you can go to the big books,—Baker and Inglis' *Birds of Southern India* (Government Press, Madras, 1930), or the eight-volume *Fauna of British India,—Birds.* But it is not necessary to know all the details of colouration when you meet a new bird. Having learned to recognize the species by a few distinctive marks or habits, you can fill in for yourself by observation the interesting and significant details. For some idea of the vast amount of fascinating information there is to be learned about each species, turn to Whistler's *Popular Handbook of Indian Birds.* Many of our species do not appear in Whistler's book, however.

Scope. All the species in this list have been recorded on the Palni Hills between 6,000 and 8,000 ft. elevation. I have limited myself to birds that are present during the season from April to June, since most people are in Kodaikanal then. There are only a few migrants and winter visitors in the list. I have omitted, for the most part, birds with which I am not personally acquainted. There may be some serious omissions because I have not been afield enough or in the right places. However, I am consoled by the knowledge that there is no such thing as a complete bird-list for any locality, since the day after a list is published a new bird may turn up. I have avoided as far as possible all reference to birds of the plains, since people who study birds in Kodaikanal may have little or no knowledge of the plains-birds of Madura District. The scientific ornithologist will ask for confirmation of some of my records by specimens. To this I reply that I do not use a gun, nor have I had personal access to any specimens collected at Kodaikanal. I have received some help, however, by a study of the following published lists, which are based for the most part on specimens collected :

'A List of Birds Collected and Observed on the Palani Hills', by Rev. S. B. Fairbank, D.D., in *Stray Feathers*, vol. v, 387 ff.

'A Few Additional Notes on Birds on the Pulney Hills', by Terry in *Stray Feathers,* vol. x, 467 ff.

'The Ornithology of Travancore and Cochin', by Sālim Ali in this *Journal*, beginning in vol. xxxvii. Mr. Sālim Ali collected in the High Range within 25 miles of Kodaikanal, and he is my authority for the names I have used, many of which are different from those found in *The Birds of Southern India*, thanks to the recent work on nomenclature done by Mr. Hugh Whistler.

TITS.

1. **Travancore Yellow-cheeked Tit.** *Machlolophus xanthogenys travancoreensis.*

Length : 6 in., the same as the Chat.

Field-marks : A wide black line below from the bill to the tail. Crested head. The head is black, with eyebrows and cheeks pale yellow.

Haunts : Trees, usually high up. They travel about in small groups, often in company with White-eyes. Fairly common.

Song: A high-pitched clear whistle of several emphatic notes. Rather like a Grey-headed Flycatcher's call.

NUTHATCHES.

2. **Velvet-fronted Nuthatch.** *Sitta frontalis.*

Length: 5 in., smaller than the Chat.

Field-marks: Deep-blue above, rusty-white below. Bill red. A short, thick-set bird.

Haunts: It runs about on the bark of trees, often head down. From two to ten may be seen together, usually in thick woods. Fairly common.

Call: A rapid series of high-pitched 'chip's'.

LAUGHING THRUSHES.

3. **Wynaad Laughing Thrush.** *Garrulax delesserti.*

Length: 10 in., larger than the Myna.

Field-marks: Brown and slaty above. Cheeks and throat white. It lacks the conspicuous white eye-brow of the next species.

Haunts: Underbush. I have only one doubtful record of it, but the late F. Dawson thought he had seen it on its nest near Pillar Rocks. Rare.

Call: Said to be a very noisy bird.

4. **Palni Laughing Thrush.** *Trochalopteron jerdoni fairbanki.*

Length: 8.5 in., smaller than the Myna.

Field-marks: White eye-brow, with black lines above and below it. Olive-brown upper parts. Breast grey, abdomen rufous.

Haunts: Bushes and thick trees, in the settlement as well as in the wilder sholas. Discovered at Kodaikanal by Rev. S. B. Fairbank in 1867. Abundant.

Calls: Loud shrieks of delight, whistles of surprise, or snatches of laughter, which have a ventriloquial effect of being more distant than they really are. Often when one bird calls, all within hearing join, making the woods ring.

SCIMITAR BABBLERS.

5. **Travancore Scimitar Babbler.** *Pomatorhinus horsfieldii travancoriensis.*

Length: 8.5 in., smaller than the Myna.

Field-marks: Curved yellow bill like a scimitar. Plumage dark-brown, with pointed white breast-patch and eye-brow.

Haunts: Woods and sholas, usually in thick foliage. It sometimes clings to the bark of trees like an enlarged Nuthatch. Not often seen, but fairly common.

Call: Loud and wooden, resembling the tone of the Barbet, but lower and more deliberate. The notes often are: *do, do, do, do,* and then up to *fa, la.* As others have put it, one calls, 'Wot-ho-ho-ho', and before this is fairly out of his mouth comes the flute-like reply from his mate in the next bush, 'Yes, dear.'

BULBULS.

6. **South Indian Black Bulbul.** *Microscelis psaroides ganeesa.*

Length: 10 in., larger than the Myna.

Field-marks: Blackish, with rather long, curved, bright-red bill. There is a short rough crest on the head. Grey below, especially toward the tail. The tail is longer than a Blackbird's.

Haunts: Constantly moving about in the tree-tops in larger sholas. Often one meets large, loose flocks. Fairly common.

Calls: Loud, harsh screams, uttered most of the time. They would be very unpopular if they came near houses much.

7. **Ceylon Red-vented Bulbul.** *Molpastes cafer.*

Length : 8 in., smaller than the Myna.

Field-marks: The whole head is black, with a rough crest. Most of the plumage is grey-brown with markings like scales.

Haunts : About gardens or on bushy slopes. I have never met it above 5,200 ft. elevation, but others have found it occasionally at Kodaikanal.

Call : A cheerful, bubbling whistle, rather lower in pitch and rougher than the call of the Red-whiskered.

8. **Southern Red-whiskered Bulbul.** *Otocompsa jocosa fuscicaudata.*

Length : 8 in., smaller than the Myna.

Field-marks: A sharp black crest, curving forward. Small red moustache. White below, with a brown collar-line.

Haunts : In bushy places, often in large flocks. Abundant.

Call: A musical series of whistled notes, high-pitched and tinkling.

9. **The Yellow-browed Bulbul.** *Iole icterica.*

Length : 8 in., smaller than the Myna.

Field-marks: A bright-yellow bird, when seen from below. Above, olive-green, with brown wings.

Haunts: The upper branches in thick woods, where it travels in loose companies up to 60 in number. I have not seen it in Kodaikanal, but Fairbank wrote that it came to 'the top'. Probably rare at this height.

Call: A clear, mellow, double whistle, given frequently.

SHORTWINGS.

10. **White-bellied Shortwing.** *Brachypteryx major albiventris.*

Length: 6.5 in., larger than the Chat.

Field-marks : A dark-blue bird with light-brown eyes, white rump, and rounded wings. Compare this description with that of the Nilgiri Flycatcher, which is very similar. Young birds are spotted like those of the flycatchers.

Haunts: Thick undergrowth in the sholas. Most in evidence at dusk, when they come out onto roads and paths. Discovered in Kodaikanal by Rev. S. B. Fairbank in 1867. Fairly common.

Song: Beautiful and sprightly, long-continued and varied, uttered as the bird moves from twig to twig among the shadows. It is thrush-like in quality, but higher in pitch.

Calls: A loud chattering, and at times a faint high whistle.

CHATS.

11. **Southern Indian Stone Chat.** *Saxicola caprata atrata.*

Length: 6 in., smaller than the House Sparrow.

Field-marks: A stubby black bird with three white patches, on shoulders and rump. The female is brown with a pink rump.

Haunts: It perches on a bush-top in an open place, making short dashes to the ground or up into the air for insects. Abundant.

Call: Gives it its name. The song is short but rather sweet.

ROBINS.

12. **Ceylon Magpie-Robin.** *Copsychus saularis ceylonensis.*

Length: 9 in., smaller than the Myna.

Field-marks: A long-tailed black bird, with white belly and white in the wings and tail, but none on the rump.

Haunts: Orchards up to the level of Kodaikanal. Regularly found in the valley below the United Church.

Song: Clear, shrill, and varied, divided into short phrases. Heard most early in the morning.

THRUSHES.

13. **Travancore Blackbird.** *Turdus simillimus bourdilloni.*

Length: 10 in., larger than the Myna.

Field-marks: All blackish, with orange bill and legs. The female is dark-brown and grey. Many birds have yellow legs, and seem closer to *T. s. simillimus,* the Nilgiri Blackbird. Whistler thinks our Palni Hills birds are intermediate, but closer to Bourdillon's.

Haunts: In trees. It does not come out on open lawns, as much as its relatives, the English Blackbird and American Robin. Common.

Song: Loud, clear, and varied. Sung with a few pauses all day long.

14. **Nilgiri Thrush.** *Oreocincla dauma neilghiriensis.*

Length: 9.5 in., the same as the Myna.

Field-marks: Above, brown, somewhat spotted. The wing is barred with black. Below, white with brown spots.

Haunts: Forests, where it searches for insects among fallen leaves. The only record I know for Kodaikanal is by Terry, who shot one on its nest on June 7th.

Song: Said to be not so continuous as that of the Blackbird, but with longer intervals between brief phrases.

15. **Malabar Whistling Thrush.** *Myophonus horsfieldii.*

Length: 12 in., as large as the Dove.

Field-marks: Black, with patches of bright blue on wings and forehead.

Haunts: Along a water-course in a wild and wooded ravine. Fairly common.

Song: Heard at sunset and early in the morning. The smoothness and clearness of its tones, and the length and variety of the song, are remarkable. It has forgotten its tune, but it whistles on. Many of the tones are lower than the human whistler can reach, so the name 'Whistling Schoolboy' is not entirely appropriate.

FLYCATCHERS.

16. Tickell's Blue Flycatcher. *Muscicapula tickelliae.*

Length: 6 in., the same as the Chat.

Field-marks: Dark blue, but with the breast reddish.

Haunts: Large shady trees without undergrowth. Fairbank observed it frequently from top to bottom of the hills, but I have met it only in the lower hills. Rare.

Song: Said to be 'a musical little trill', or 'a little whistling chirrup'.

17. Nilgiri Blue Flycatcher. *Eumyias albicaudata.*

Length: 6 in., the same as the Chat.

Field-marks: Dark-blue nearly all over. The outer tail feathers are white at the base. Vent grey. Legs black. It should be carefully compared with the Shortwing. The female is dull brown and blue. Young speckled birds with only a few spots of blue are often seen.

Haunts: In trees, near houses or in remote sholas. Common.

Song: A mild, rather sweet song of 6 or 8 notes, often with a glide in each note that gives it a somewhat mournful effect. The bird is lethargic, and sings for a long time from one open perch all through the day.

18. Black and Orange Flycatcher. *Ochromela nigrorufa.*

Length: 5 in., smaller than the Chat.

Field-marks: Head, neck, and wings black, the rest burnt-orange.

Haunts: In the thickest bushes of the darkest sholas. Fairly common.

Song: Rather sweet, but hoarser than that of the Grey-headed. It has usually only three notes to a phrase, and is a little lacking in animation.

Call: A series of 4 or 5 chattering notes.

19. Grey-headed Flycatcher. *Culicicapa ceylonensis.*

Length: 5 in., smaller than the Chat.

Field-marks: A dark-blue head (in spite of the name). The rest of the bird is yellow and olive.

Haunts: Found in groups or pairs in the sholas. They are seldom still, but constantly dashing about, catching insects on the wing. Common.

Song: A thin and high-pitched trill, somewhat metallic in quality. It has a call of four whistled notes, sweet and clear. There is also a variety of explosive alarm-notes.

SHRIKES.

20. **Southern Rufous-backed Shrike.** *Lanius schach caniceps.*
Length: 9 in., smaller than the Myna.

Field-marks: A black mask over the eyes. Ashy-grey above and white below. Rump, sides, and lower back are rufous.

Haunts: It chooses an open and conspicuous perch. Common.

Call: Its nasal grating note is longer than a similar note of the Myna's. Its song, not a bad attempt, is less commonly heard.

21. **Black-backed Pied Shrike.** *Hemipus picatus.*
Length: 5.5 in., smaller than the Chat.

Field-marks: Head and upper parts mainly black, beneath white.

Haunts: An active bird of the tree-tops, sometimes in company with White-eyes and Tits. Uncommon.

Song: Weak and high-pitched, but clear and varied. One form of it see-saws back and forth between two notes.

MINIVETS.

22. **Orange Minivet.** *Pericrocotus flammeus.*
Length: 8 in., smaller than the Myna.

Field-marks: Head and upper back black, the rest bright red-orange. The female is yellow, grey, and black.

Haunts: Always seen in small flocks in the tree-tops. Fairly common.

Call: Some high, clear whistles draw one's attention to the arrival of a flock in a nearby tree. The song is a shrill, pleasant warble, not often heard.

SWALLOW SHRIKES.

23. **Ashy Swallow-Shrike.** *Artamus fuscus.*
Length: 7 in., larger than the Chat.

Field-marks: A short, thick-set bird, with short, pointed wings. Bill thick and pale-blue. Plumage dark bluish-ashy.

Haunts: They may be seen, often in pairs, sitting motionless on a high branch of a blue-gum tree, or soaring slowly in mid-air. Uncommon.

Call: A soft nasal 'yank', which is easily remembered when once heard.

DRONGOS.

24. **Southern Bronzed Drongo.** *Chaptia aenea malayensis.*
Length: 9 in., smaller than the Myna.

Field-marks: Glossy blue-black, with a long forked tail.

Haunts: Open perches. I have seen a Drongo in Kodaikanal only once, at Pambar House garden. It was most likely this species, which is found in the lower hills. Rare.

Song: Much sweeter than the plains bird's.

WARBLERS.

25. **Blyth's Reed Warbler.** *Acrocephalus dumetorum.*
Length: 6 in., the same as the Chat.

Field-marks: Tail long and graduated. Olive-brown above. A pale streak from top of bill to eye. Throat whitish, belly pale buff.

Haunts: Dense undergrowth. In Travancore, this is a winter visitor, leaving in mid-April. But Terry shot one at Putthur (6,000 ft.) on June 26th, and saw a pair at Kukkal. So perhaps it breeds in these hills. Rare.

Call: A sudden 'chick' or 'chuck' or 'chur-r-r', at frequent intervals.

Song: A slight warble, according to Wait.

26. **Red-headed Fantail Warbler.** *Cisticola exilis erythrocephala.*

Length: 4 in., smaller than the Chat.

Field-marks: The top of the head is chestnut. The back has black streaks. The under-parts are rusty.

Haunts: Open grass-lands. I have found it common only in a few localities.

Call: A nasal 'peeeenk', followed by a clear whistled 'toowhee'. (Beavan's Wren-Warbler, *Franklinia rufescens,* and the Rufous-fronted Wren Warbler, *Franklinia buchanani,* are said by the authorities not to be found as far south as Kodaikanal. I have records that seem nearer to these than to any other species. Perhaps further collecting on the Palni Hills will show an extension of the known range of at least one of the Franklinias.)

27. **Broad-tailed Grass Warbler.** *Schoenicola platyura.*

Length: 7 in., larger than the Chat.

Field-marks: The under-parts are bright-rusty, except for a white band down the centre. Above, red-brown. The eye-brow is grey and inconspicuous.

Haunts: Bracken slopes, singing from a bush-top. Uncommon.

Song: A shrill and sweet trill, ending with a few warbling notes and 'chack's'. It is the best song of any of our warblers'.

28. **Thick-billed Warbler.** *Phragamaticola aëdon.*

Length: 7.5 in., larger than the Chat.

Field-marks: Above, light-brown, with a tinge of yellowish. No white eye-brow. Tail graduated.

Haunts: Tall grass and weeds. A winter visitor only, but I have records until May 2nd. Rare.

Call: A loud, harsh 'chuck' and 'chur-r', quickly repeated.

29. **Sykes' Tree Warbler.** *Hippolais rama.*

Length: 5.5 in., smaller than the Chat.

Field-marks: Tail slightly rounded. Olive-brown above, with a faint pale eyebrow. Below, pale buff, with the throat and centre of abdomen nearly white.

Haunts: Thick bushes. A winter visitor staying into April. Rare.

Call: A low wren-like chatter.

30. **Tickell's Willow Warbler.** *Phylloscopus affinis.*
Length: 4.5 in., smaller than the Chat.

Field-marks: Deep yellow below, dull olive above. No wing-bars. Yellow eye-brow.

Haunts: Trees, moving about constantly among the leaves. A winter visitor staying through April. Fairly common.

Song: A brief, twittering warble.

31. **Green Willow Warbler.** *Phylloscopus nitidus nitidus.*
Length: 5 in., smaller than the Chat.

Field-marks: Green above, yellow below. Two wing-bars. Yellow eye-brow.

Haunts: Trees. A winter visitor, noted as late as mid-May. Rare.

Call: A little 'chirrup' or 'chi-wee'.

32. **Greenish Willow Warbler.** *Phylloscopus nitidus viridanus.*
Length: 5 in., smaller than the Chat.

Field-marks: One faint wing-bar. Yellow eyebrow. Olive-brown above, under-parts yellowish grey.

Haunts: A restless bird, found in heavy foliage. It is a winter visitor only, and disappears about the middle of May. Fairly common.

Song: A brief, pleasant warble of four or five notes, given very frequently.

33. **Large-billed Willow Warbler.** *Phylloscopus magnirostris.*
Length: 5.5 in., smaller than the Chat.

Field-marks: Two wing-bars. Yellow eye-brow. Below, pale yellow, with much grey on the breast.

Haunts: A winter visitor, in trees, staying until late in April. Said to be common in the Travancore hills. I have only a few doubtful records. Rare.

Song: A whistle of 2 or 3 or 4 syllables (authorities differ), almost robin-like in tone.

34. **Western Dull-green Willow Warbler.** *Phylloscopus trochiloides ludlowi.*
Length: 5 in., smaller than the Chat.

Field-marks: The eye-brow is smaller and less conspicuous than in the preceding species.

Haunts: Some of our transient warblers in April probably belong to this species. In trees. Rare?

Call: A sparrow-like chirp, repeated several times in succession.

35. **Large-crowned Willow Warbler.** *Phylloscopus occipitalis.*
Length: 5 in., smaller than the Chat.

Field-marks: Resembles the other willow-warblers, but there is a distinct pale line from the bill backward over the top of the head.

Haunts: Trees. A winter visitor only. My only record is on April 21.

Call: A loud, sharp 'tit-weet'.

36. **Ashy Wren-Warbler.** *Prinia socialis.*

Length: 5.5 in., smaller than the Chat.

Field-marks: Smooth bluish-grey above. Black line through eye. Below, pink. The most brightly-coloured of our warblers.

Haunts: Bracken slopes, where it sings from a bush-top or in a short flight. Common.

Song: A shrill, emphatic, double note, repeated 5 or 6 times together. In rhythm, this song is similar to that of the Tailor-bird but its tone is less musical.

Calls: A cat-like snarl, and a nasal scolding.

37. **South Indian Wren-Warbler.** *Prinia inornata franklinii.*

Length: 6 in., the same as the Chat.

Field-marks: Dull brown above, the feathers slightly darker at their centres. Eye-brow white. Tail white-tipped.

Haunts: Bracken slopes, especially on the higher hills. Common.

Song: An insect-like 'tlik, tlik—', more wheezy than the preceding.

Call: A little 'kink, kink,—'.

MYNAS.

38. **Southern Jungle Myna.** *Aethiopsar griseus mahrattensis.*

Length: 9.5 in., larger than the Bulbul.

Field-marks: Some erect feathers on the forehead. It lacks the bare yellow skin around the eye of the plains bird, and is more slaty than brown.

Haunts: About houses. Its name 'Jungle' is a mistake, as far as we can see in Kodaikanal. Abundant.

Calls: Varied and rough, less musical than those of the Common Myna.

MUNIAS.

39. **Black-headed Munia.** *Munia malacca.*

Length: 5 in., smaller than the Chat.

Field-marks: Black head, chestnut-red wings and back, and white belly. Its thick, seed-crunching bill is pale blue in colour.

Haunts: Small flocks in weeds on open hillsides or in gardens. Uncommon.

Call: A very sweet chattering.

40. **White-throated Munia.** *Uroloncha malabarica.*

Length: 5 in., smaller than the Chat.

Field-marks: Plumage light-brown above, white below and on face. The tail is blackish and wedge-shaped. Bill dull bluish.

Haunts: Bushy hillsides. Rare.

Call: A feeble 'chee, chee,——'.

41. **Indian Spotted Munia.** *Uroloncha punctulata lineoventer.*

Length: 5 in., smaller than the Chat.

Field-marks: Dark red-brown head, golden-brown back. Below, blackish, finely dotted with white.

Haunts: Found in small flocks in weeds, chiefly at lower elevations. Rare.

Call: A petulant 'kitty-kitty-kitty', according to Whistler.

42. **Indian Red Munia.** *Amandava amandava.*

Length: 4 in., smaller than the Chat.

Field-marks: Dark red, with some small white spots. The female is a brown bird with only a little red on the back.

Haunts: In flocks in bushes on open hillsides. Uncommon.

Calls: A high-pitched musical twittering.

FINCHES.

43. **Common Indian Rose Finch.** *Carpodacus erythrinus roseatus.*

Length: 6 in., the same as the Chat.

Field-marks: Brown, tinged with rosy, especially on the head. Conical bill.

Haunts: I have seen it only along the edges of sholas. A winter visitor, until mid-April. Rare.

Song: Said to be rather pleasant.

SWALLOWS.

44. **Nilgiri House Swallow.** *Hirundo javanica domicola.*

Length: 5 in., smaller than the Chat.

Field-marks: Glossy blue-black above. Tail forked, spotted near the end with white.

Haunts: Breeds in a few houses, especially near Coaker's Walk. It swoops low through the air, bringing its wings back close to its body with each stroke. Contrast the Swift's method of flying. Fairly common.

Calls: A musical twittering, and a variety of shrill squeals and whistles.

WAGTAILS.

45. **Large Pied Wagtail.** *Motacilla maderaspatensis.*

Length: 9 in., smaller than the Myna.

Field-marks: Head, throat, and back black. Eye-brow and lower parts white. Long tail.

Haunts: Around the lake and along water-courses. Often finds its food on lawns. A convenient housetop is a favourite perch. Fairly common.

Song: High-pitched, long, and clear,—one of the finest at Kodaikanal.

46. **Eastern Grey Wagtail.** *Motacilla cinerea caspica.*

Length: 7.5 in., larger than the Chat.

Field-marks: Grey above, yellow and white below. A constantly wagging tail.

Haunts: This is a winter visitor, but until mid-May is a conspicuous bird, likely to be met anywhere in the settlement, on the ground. Common.

Call: A high-pitched, strong 'seep'.

PIPITS.

47. Indian Tree Pipit. *Anthus hodgsoni.*

Length: 7 in., larger than the Chat.

Field-marks: Streaky olive-brown above. Below, creamy and white, with brown spots all the way from the neck to the vent.

Haunts: A winter visitor, leaving in April or early May. Found on the ground in shady places, where it can fly into a tree for safety. Fairly common.

Call: A faint, plaintive note.

48. The Nilgiri Pipit. *Anthus nilghiriensis.*

Length : 7 in., larger than the Chat.

Field-marks: Streaked with black and pale olive above. Eyebrow rufous. Lower parts tawny, the breast and sides being streaked with black.

Haunts : Open grassy hills. I think I have seen it a few times. Fairbank called it common, and Terry found it more common than the Malay Pipit.

Song: A chipping song given while fluttering in the air, probably belongs to this species.

49. Rufous Rock Pipit. *Anthus similis.*

Length: 8 in., smaller than the Myna.

Field-marks : A narrow black moustache. Only the breast is spotted with brown. Above, streaky dark-brown. Below, creamy, and eyebrow of the same colour.

Haunts: I have found it regularly on the swampy meadow near the south-west corner of the lake, and occasionally elsewhere. Fairly common.

Song : A feeble, high whistle, given during a circular dipping flight, followed by a dive to the ground. Or, a few high-pitched 'chip's'.

50. The Malay Pipit. *Anthus rufulus malayensis.*

Length: 6.5 in., larger than the Chat.

Field-marks: Streaked above with pale brown, dark brown, and blackish. The eye-brow and lower parts are pale creamy. The sides and breast are streaked with dark brown.

Haunts : In open grassy land. I have found it at the south-west corner of the lake. Fairly common.

Song : Five to ten 'chink's', uttered while flying up a short distance.

LARKS.

51. Small Nilgiri Sky Lark. *Alauda gulgula australis.*

Length : 6.5 in., larger than the Chat.

Field-marks : Streaked with dark brown and rufous above. Eye-brow and under-parts tinged with rufous. The breast is streaked with brown. Distinguished from the Pipits by its more crouching position, and its habit of squatting instead of running away when one approaches.

Haunts: On the downs outside the settlement. Abundant.

Song: Long, sweet, and inspiring, given while the bird soars higher than the eye can follow.

Call: A liquid 'chirrup'.

52. **Malabar Crested Lark.** *Galerida malabarica.*

Length: 7 in., larger than the Chat.

Field-marks: A crest on the head; otherwise a streaky brown bird like the Sky Lark.

Haunts: Grassy hill-tops just beyond the houses. Fairly common.

Song: Said to resemble the Sky Lark's. Often, a lark song is a mere chattering or chipping, and lasts not more than a quarter of a minute. Perhaps such songs are from this species.

Call: A rather sweet 'tee-ur', according to Whistler.

WHITE-EYES.

53. **The Nilgiri White-eye.** *Zosterops palpebrosa nilgiriensis.*

Length: 4 in., smaller than the Chat.

Field-marks: Yellow-green above. Breast yellow, belly white. A white eye-ring.

Haunts: Always found in trees or bushes, busily moving from branch to branch in loose companies. Abundant.

Song: Their mild querulous notes are heard all the time. They remind me of the call of a baby chick which is somewhat sleepy. The song is a brief, weak trill.

SUNBIRDS.

54. **The Small Sunbird.** *Cinnyris minima.*

Length: 3.5 in., our smallest bird (with the Flowerpecker).

Field-marks: Curved bill. Head and neck dull green. Wings dark brown. Underparts entirely deep yellow. There are other plumages, and in them all the red back is a distinguishing mark, but this is not easy to see.

Haunts: About flowers. Fairly common.

Song: A loud, ringing trill.

SPIDER-HUNTERS.

55. **Little Spider-hunter.** *Arachnothera longirostra.*

Length: 6 in., one-fourth of which is bill. Smaller than the Chat.

Field-marks: An extra-long bill. Throat white, belly yellow. Above, dull brown, grey, and olive.

Haunts: Around flowering trees. Rare.

FLOWERPECKERS.

56. **Nilgiri Flowerpecker.** *Dicaeum concolor.*

Length: 3.5 in., shares with the Small Sunbird the distinction of being our smallest bird.

Field-marks: Very dull coloured. The upper parts are green and brown, the lower parts whitish. Face white.

Haunts : A restless bird, seldom allowing a good view. Always well up in trees, favouring those that have parasitic growths on them. Abundant.

Call: A sharp 'check' makes identification easy.

Song : A high-pitched trill, weak and wiry.

WOODPECKERS.

57. Little Scaly-bellied Green Woodpecker. *Picus xanthopygaeus.*

Length: 11 in., smaller than the Dove.

Field-marks: The back is green and much-spotted. The male has a large red crest, the female a black one.

Haunts: On tree-trunks and large branches. Uncommon.

Call: Its drumming is as rapid as a steam-hammer, and must give the bird the same satisfaction that most birds get from singing. Its call is a single, mild, falsetto note, not often heard.

58. Malherbe's Golden-backed Woodpecker. *Chrysocolaptes guttacristatus chersonesus.*

Length : 11 in., smaller than the Dove.

Field-marks : The back and wings are golden-olive, lower back crimson. The male is red-crested, the female content with black. The black and white lines on the side of the head are conspicuous.

Haunts: On tree-trunks. Uncommon.

Call : A harsh scream of several syllables.

BARBETS.

59. Small Green Barbet. *Thereiceryx viridis.*

Length : 9.5 in., the same as the Myna.

Field-marks: All green, except for a streaked brown head and white chin. The bill is heavy and flesh-coloured.

Haunts: In thick trees, where its bright colour matches the leaves. Abundant.

Song : Wooden in tone, loud, and frequently uttered. One form is a long trill, followed by a two-syllabled 'hook-krrr', often repeated. When one bird sings, others join in the chorus. The Hoopoe's note is softer in tone, the Scimitar's deeper.

CUCKOOS.

60. Southern Crow-Pheasant. *Centropus sinensis parroti.*

Length: 19 in., larger than the Dove.

Field-marks : All black, except for the wings, which are red-chestnut. The eyes are red.

Haunts: This dignified, overgrown cuckoo is found in thick bushes and on the ground, often near houses. I have seen it only once as high as Kodaikanal. Rare.

Call: A hoot of very deep tone. It is loud enough to be heard clearly a mile or more away. Except that it does not inhale, it reminds one of the call of the Langur Monkey.

KINGFISHERS.

61. **Common Ceylon Kingfisher.** *Alcedo atthis taprobana.*
Length: 6 in., the same as the Chat.

Field-marks: Bright-blue back. The head is dark, with a streak of white behind the eye. Below, chestnut. **The Three-toed Kingfisher** with its orange head and rump, may also occur here.

Haunts: Lakes and streams. Uncommon.

Call: A sharp squeak.

62. **Ceylon White-breasted Kingfisher.** *Halcyon smyrnensis fusca.*

Length: 10.5 in., larger than the Myna.

Field-marks: Large red bill, with an oversized head. White breast, sharply contrasted with dark brown below and blue above.

Haunts: Usually they nest in the sand-bank near the ball-field. Uncommon.

Call: A loud, defiant, rattling laugh.

HOOPOES.

63. **Ceylon Hoopoe.** *Upupa epops ceylonensis.*

Length: 11 in., smaller than the Dove.

Field-marks: A remarkable rufous and black crest, which it folds and spreads frequently, like a fan. Mostly tan-coloured, with black and white wings. A long, curved bill.

Haunts: Never far from houses, in any opening of which it nests. Feeds mostly on the ground. Common.

Call: A soft, wooden 'hoop, hoop', softer than a Barbet's notes. Sometimes, three 'hoop's' are given together.

SWIFTS.

64. **White-rumped Spinetail.** *Indicapus sylvaticus.*

Length: 4.5 in., smaller than the Chat.

Field-marks: Blackish, with both rump and belly white.

Haunts: In the air all the time, usually near forests at lower elevations. I have seen it only once near Pillar Rocks.

Call: A rapidly-repeated 'swicky-sweezy'.

65. **Indian Alpine Swift.** *Micropus melba bakeri.*

Length: 8 in., smaller than the Myna.

Field-marks: The lower parts are white, except for a brown band across the breast. The upper plumage is smooth brown. Tail forked.

Haunts: Seen singly, high in air, flying very swiftly and soaring a good deal. The manner of flight of any swift distinguishes it at once from a swallow. The swift's wings are not brought back parallel with the body, but are held well out from the body like the flukes of an anchor. Uncommon.

Call: Loud, shrill, and tremulous.

66. **Nepal Indian House Swift.** *Micropus affinis nipalensis.*

Length: 5 in., smaller than the Chat.

Field-marks: A blackish bird with a white rump.

Haunts: In large flocks high in the air, occasionally at Kodaikanal, more common at other places in the hills.

Call: A musical twittering, kept up all the time.

67. **Indian Edible-nest Swiftlet.** *Collocalia fuciphaga unicolor.*

Length: 5 in., smaller than the Chat.

Field-marks: Dull brown above, with darker wings. Grey below. The Swiftlet is a slow-flying bird, and flutters much more than the Swallows and other Swifts.

Haunts: Seen flying over the lake or open places anywhere. Said to nest in the 'chimney' at Pillar Rocks. Abundant.

Call: A shrill twittering, less musical than that of the House Swift. Often they are silent.

68. **Indian Crested Swift.** *Hemiprocne coronata.*

Length: 9 in., smaller than the Myna.

Field-marks: Blue-grey above, grey and white below. The blackish tail is very deeply forked.

Haunts: Flying. Rare.

Call: Resembles a parrot's scream.

NIGHTJARS.

69. **Indian Jungle Nightjar.** *Caprimulgus indicus.*

Length: 11 in., smaller than the Dove.

Field-marks: The tail has a broken band of white across near the end. The general effect is grey-brown, much mottled.

Haunts: Near woods, at night. Terry found it common at some places in the hills. Rare at Kodaikanal.

Call: *Do-sol* (lower), repeated over and over. Also, a low 'chuck'.

OWLS.

70. **Bengal Brown Fish Owl.** *Ketupa zeylonensis leschenaulti.*

Length: 24 in., twice as large as the Dove.

Field-marks: Ear-tufts ('horns') present. The facial disc is not clear.

Haunts: Sholas, at night. Rare.

Call: 'Gloom-oh-gloom', in a solemn bass voice.

VULTURES.

71. **Indian Long-billed Vulture.** *Gyps indicus.*

Length: 38 in., our largest bird.

Field-marks: Brown and whitish, rather patchy in appearance. A young White Vulture will answer to this description also, but is readily told by its size.

Haunts: Usually below the town. Rare.

72. **Indian White-backed Vulture.** *Pseudogyps bengalensis.*

Length: 35 in., three times as large as the Dove.

Field-marks: A blackish bird, with white patches on the lower back, sides, and under-wings. Like the other vultures, its head appears too small for its heavy body and broad wings.

Haunts: Often several soaring about below the bazaar. Fairly common.

73. **Smaller White Scavenger Vulture.** *Neophron percnopterus ginginianus.*
Length: 24 in., twice as large as the Dove.
Field-marks: Yellowish-white, with some black in the wings.
Haunts: Chiefly below the bazaar, looking for carrion and garbage. Fairly common.

FALCONS.

74. **Indian Kestrel.** *Falco tinnunculus objurgatus.*
Length: 13 in., larger than the Dove.
Field-marks: A slender, long-tailed hawk, mainly red and blue in colour.
Haunts: Open hillsides. It often stands in one spot in the air, either by beating its wings rapidly or by facing the wind almost motionless. Fairly common.
Call: A shrill laughing scream.

EAGLES.

75. **Bonelli's Eagle.** *Hieraëtus fasciatus.*
Length: 27 in., over twice as large as the Dove.
Field-marks: Below, white with black streaks. Above, dark brown with white splotches. Tail cross-barred below.
Haunts: This dignified bird may be met along the borders of woods, in or out of the settlement. Uncommon.
Call: Shrill and creaking.

76. **Indian Black Eagle,** *Ictinaëtus malayensis perniger.*
Length: 27 in., over twice as large as the Dove.
Field-marks: All black, except for yellow beak and legs.
Haunts: Not far from forests. I have seen a pair in the open from Coaker's Walk.
Call: A shrill cry.

KITES.

77. **The Brahminy Kite.** *Haliastur indus.*
Length: 20 in., larger than the Dove.
Field-marks: Head and neck white, the rest chestnut-brown. The immature bird is splotchy, and its best mark is a prominent white band across the under side of the wing.
Haunts: May be seen flying anywhere about the settlement, not far from water. Uncommon.
Call: A squealing note.

78. **The Common Kite.** *Milvus migrans govinda.*
Length: 21 in., larger than the Dove.
Field-marks: Tail slightly forked. Streaky dark-brown plumage.
Haunts: Anywhere around the town, in the air, looking for scraps to eat. Common.
Call: A shrill, quavering scream.

BUZZARDS.

79. **Black-winged Kite.** *Elanus caeruleus vociferus.*
Length: 13 in., larger than the Dove.
Field-marks: Above, grey and black. The forehead, lower parts, and most of the tail, are white.
Haunts: They fly low over grassy hilltops, as graceful as terns over the sea. Rare.
Call: Said to be a thin, high-pitched squeal.

HAWKS.

80. **Indian Shikra.** *Astur badius dussumieri.*
Length: 13 in., larger than the Dove.
Field-marks: A small, slender, ashy-grey hawk. The wings are short and rounded, the tail long.
Haunts: Dashes through light forest. I have only two Kodaikanal records.
Call: A loud, shrill cry, 'titu, titu——'.

PIGEONS.

81. **Jerdon's Imperial Pigeon.** *Ducula badia cuprea.*
Length: 17 in., larger than the Dove.
Field-marks: Grey, bluish, and brown. Throat white.
Haunts: They sit quietly in heavy trees in sholas. Rare.
Call: A loud, booming 'who, whoo'.

82. **Indian Blue Rock Pigeon.** *Columba livia intermedia.*
Length: 12 in., the same as the Dove.
Field-marks: Slaty-blue, with black bars in wings and tail. The tail is short and squarish. This is the ancestor of the domestic pigeon.
Haunts: In the vicinity of rocky cliffs where they nest. Uncommon.
Call: Resembles that of the domestic bird.

83. **Nilgiri Wood Pigeon.** *Columba elphinstonii.*
Length: 16 in., larger than the Dove.
Field-marks: Brown wings. On the side of the neck, a black patch with small white spots in it. Otherwise greenish-grey.
Haunts: They sit quietly in dense trees. Uncommon.
Call: 'Coo's' of very low tone, from four to eight in number. Softer than the Crow-Pheasant's call, they are more owl-like in quality.

DOVES.

84. **Indian Spotted Dove.** *Streptopelia chinensis suratensis.*
Length: 12 in., larger than the Hoopoe.
Field-marks: Head is small in proportion to the body. The tail is longer than in the pigeons. The wings and back are pale brown with lighter spots. Otherwise, mostly ashy-grey.
Haunts: In trees. Common.
Call: A soft, wooden 'cuck*oo*, cooo, cooo, cooo'. The tone is similar to the Hoopoe's note, but the rhythm is distinctive.

JUNGLE FOWL.

85. **Grey Jungle Fowl.** *Gallus sonneratii.*
Length: 30 in., half of which is tail. A large bird.
Field-marks: Black and brown with white spots.
Haunts: Larger jungles, mostly below Kodaikanal. Uncommon.
Call: A fowl-like crow, 'kuk-kaa kurra kuk'.

SPUR-FOWL.

86. **Travancore Red Spur-Fowl.** *Galloperdix spadicea stewarti.*
Length: 15 in., larger than the Dove.

Field-marks: A slender, pheasant-like fowl. Dark brown and chestnut, with a red bill.

Haunts: Larger jungles and pine plantations. Fairly common.

Call: A chuckling or cackling cry, usually of only two syllables.

QUAIL.

87. **Malabar Jungle Bush-Quail.** *Perdicula asiatica vidali.*
Length: 6.5 in., larger than the Chat.

Field-marks: Brown, marked with chestnut and black above. Below, cross-bars of black and white.

Haunts: On the ground, in tall grass and bushes on the downs. Rare.

Call: A whistled 'tiri-tiri-tiri'.

88. **Painted Bush-Quail.** *Cryptoplectron erythrorhynchum.*
Length: 7 in., larger than the Chat.

Field-marks: Brown, with black and buff streaks. A white throat bordered with black.

Haunts: Little groups of them run along the ground in thick grass or underbrush remote from houses. They give one the briefest sort of view when they fly off. Uncommon.

Call: A whistled 'kirikee', repeated several times.

WOODCOCK.

89. **The Woodcock.** *Scolopax rusticola.*
Length: 13 in., larger than the Dove.

Field-marks: Long bill. Stripes across the head, not lengthwise. Beautifully mottled brown, black, and white.

Haunts: A winter visitor only, staying into May. Found in woods near water. Rare.

Call: A nasal 'beep' when flying about at dusk.

SNIPE.

90. **Fantail Snipe.** *Capella gallinago.*
Length: 10.5 in., larger than the Myna.

Field-marks: A thick-set bird with a long bill. Three yellowish lines run lengthwise over the top of the head. The upper plumage is streaked black, white, and brown. Below, mostly white.

Haunts: Swampy places near sholas. Flies usually at dusk. It stays as a migrant until early May. Uncommon.

Call: A nasal 'scap'.

SOME BIRDS OF LYALLPUR AND THEIR FOOD.

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Introduction.

A number of contributions on the bird fauna of North West India have appeared from time to time in the *Journal of the Bombay Natural History Society*. Rattray (1905) and Magrath (1909) gave an account of the birds of Murree and the Gullis. Curree (1915) studied the birds of Lahore and its vicinity. Hugh Whistler (1915, 1917, 1920, 1927, 1928) investigated the avian fauna of the Dalhousie hills, Gujranwala, Ambala, Ludhiana, Fagoo (near Simla), Simla and Kulu. Jones (1920, 1921, 1927) worked on the birds of Simla, Campbellpore-Attock and Ambala. Hingston (1921) devoted his attention to the birds of Delhi. Briggs and Osmaston (1928) interested themselves in the bird fauna of Peshawar.

The recently-opened-up canal colonies have so far remained unrepresented and this opportunity is taken to place on record information regarding the birds of Lyallpur.

As friends and foes of the farmer the birds are second in importance only to the insects, and, therefore, for an agricultural country the study of the bird fauna is of paramount importance. A study of the food habits of the birds commonly found in gardens and fields at Lyallpur was taken in hand in 1926, and an area within ten miles radius of the Punjab Agricultural College, Lyallpur, has been surveyed.

It is generally recognized that the capacity for damage or good depends, largely, on the number of individuals. Every grain- or fruit-feeding species is a potential foe and every insect feeder a potential friend, but as long as the number of individuals is small the value of a particular species is insignificant. Thus it is not always possible to assign a definite status to a species.

The study of the bird fauna of Lyallpur is of added interest when one recollects, that not long ago this tract was almost barren and a most inhospitable spot. Here nothing but *Prosopis spicigera*, *Salvadora oleoides*, *Capparis aphylla*, *Tamarix articulata* grew in any abundance, *Zizyphus jujuba*, *Zizyphus numularia*, were less common, and *Acacia arabica* and *Dalbergia sissu* were rarities. Grasses which grew after scanty rains provided grazing for numerous herds of cattle. Cultivation was unknown over this vast arid tract. During the last 40 years, thanks to the canals, the entire character of the locality—climatic, floral and faunal—has changed and Lyalipur has become one of the greenest parts of the Punjab, where innumerable trees provide roosting places, and different crops and fruit trees provide sufficient food for different species and enormous flocks of birds. The introduction of different types of plants as crops and fruit, shade and ornamental trees have brought in their particular pests and thus increased the food of the insectivorous birds.

If it were possible to compare the avian fauna of 40 years ago with what it is today, one would get most interesting facts regarding the 'Balance of Life in Nature'. Unfortunately, for want of record, such a comparison is not possible. As a direct result of the colonization of this arid area, undoubtedly, there has occurred an enormous increase in the numbers of such birds as crows, sparrows, parrots and pigeons, which now find abundant food and safe dwellings. This locality is still undergoing changes and a study undertaken after a quarter of a century will perhaps prove very interesting.

It may be stated that in addition to the birds mentioned in this paper, various species of cranes, mallards, ducks, teals and snipes are found in the Lyallpur District at the canal escapes at Chaku, Beranwala, Rodukoru and Bhakat, but as these birds are not of agricultural importance, they have not been studied.

The nomenclature adopted is that of Stuart Baker (*The Fauna of British India*). (F. No..........) indicates number of the species in the *Fauna* Volumes.

Some of the birds collected were identified by the Bombay Natural History Society and the help received is gratefully acknowledged.

BIRDS OF LYALLPUR.

The following is a brief account of the birds found at Lyallpur. Most of these were actually shot and their stomach contents examined.

Family: CORVIDÆ.

(1) **The Punjab Raven.** *Corvus laurencei*, Hume (F. No. 1).

Abundance.—Common in the vicinity of town as well as in the open country; found throughout the year; 19 birds killed during different months of the year.

Food.—Omnivorous: ripening fruits and cereals, seeds and seedlings from the fields; kitchen refuse; animal flesh; eggs and young of birds; insects—locusts, *Chrotogonus* spp., ants, gram caterpillars, cutworms, beetles, etc.

Status.—Of major importance to agriculture: on the whole harmful.

(2) **The Eastern Rook.** *Corvus frugilegus tschusii* Hartert. (F. No. 9).

Abundance.—A winter visitor; not common; 5 birds killed 21-2-1929 (3) and 5-12-1928 (2).

Food.—Wheat and other grains, tender shoots of gram, other vegetable matter; insects—ants, gram caterpillars, cutworms, beetles, etc.

Status.—Of minor importance to agriculture.

(3) **The Common Indian House-Crow.** *Corvus splendens splendens* Vieill. (F. No. 11).

Abundance.—Found in myriads throughout the year; numerous tall trees provide suitable roosts. In winter (October to March) they leave their roosting places every morning in huge flocks going towards different directions and return in the evening. Killed every week throughout the year 1928-29.

Food.—Omnivorous: all kinds of ripening crops and fruits, seeds and seedlings, kitchen refuse, vegetables; lizards, eggs and nestling of birds; animal flesh; and insects—*Chrotogonus* spp., locust adults and hoppers, black ants, winged white ants, caterpillars, beetles and beetle grubs, etc.

Examination of Stomach Contents.—Cropseeds 44.13 per cent, weedseeds 2.68 per cent, vegetables 7.33 per cent, cultivated fruits 6.46 per cent, wild fruits 5.39 per cent, animal flesh etc. 8.34 per cent, injurious insects 16.15 per cent, miscellaneous, bread etc., 9.47 per cent and pebbles 0.05 per cent.

Status.—A very important bird in agriculture: certainly a serious pest in the canal colonies; its total extermination perhaps may not be desirable, but its numbers must be kept down.

(4) **The Indian Tree-pie.** *Dendrocitta rufa rufa* Latham. (F. No. 26).

Abundance.—Not very common; 7 birds killed on 24, 26-4-1930, 30-6-1926, 1-7-1928 (2); 2-8-1928; 21-12-1928.

Food.—Omnivorous: cultivated crops; fruits; lizards, spiders, eggs and nestling of birds; and insects—locust hoppers, caterpillars, beetles, etc.

Family: PARIDÆ.

(5) **The Punjab Grey-Tit.** *Parus major planorum* Hartert (F. No. 54).

Abundance.—A rare bird; only one specimen was killed on 28-11-1929.

Food.—Ants and other hymenopterous insects.

Family: TIMALIIDÆ.

(6) **The Bengal Jungle-Babbler.** *Turdoides terricolor terricolor* Hodgs. (F. No. 183).

Abundance.—Fairly common; present throughout the year, seen hopping about bushes and trunks of trees and overturning leaves in search of insects; 31 birds killed during different months of the year.

Food.—Omnivorous: grains, seeds and seedlings, weedseeds; sometimes fruits; various insects—*Chrotogonus* spp., locust, eggs and hoppers, ants, caterpillars and beetles. Insects form the major portion of its diet.

Status.—Of major importance to agriculture: beneficial.

(7) **The Common Babbler.** *Argya caudata caudata* Dumont. (F. No. 192).

Abundance.—A familiar and common bird, seen throughout the year near bushes and hedges; 17 birds killed during different months of the year.

Food.—Mainly insects—ants, caterpillars, beetles; also grains, seeds and seedlings, and weedseeds.

Status.—Of major importance to agriculture: beneficial.

Family: PYCNONOTIDÆ.

(8) **The Punjab Red-vented Bulbul.** *Molpastes hœmorrhous intermedius* Jerdon. (F. No. 404).

Abundance.—Common; generally seen in pairs throughout the year in gardens and cultivated areas; 12 birds killed during different months of the year.

Food.—Omnivorous: grains, ficus-fruit, peas; insects—locust adults and hoppers, ants, winged white-ants, caterpillars, moths, beetles, etc.

Status.—Of minor importance to agriculture: on the whole beneficial.

(9) **The White-cheeked Bulbul.** *Molpastes leucogenys leucogenys* Gray. (F. No. 405).

Abundance.—Not so common as the above, one specimen killed on 5-9-1929.

Family: TURDIDÆ

(10) **The Northern Indian Stone-Chat.** *Saxicola caprata bicolor* Sykes. (F. No. 494).

Abundance.—Not very common; only 5 birds killed on 19-3-1928, 7, 26 (2)-8-1929 and 16-9-1928.

Food.—Insects—ants, beetles, etc.

(11) **The Pied Chat.** *Œnanthe picata* Blyth. (F. No. 506).

Abundance.—Not very common, a winter visitor; only 4 birds killed on 27-8-1931, and 3, 9, 12-12-1930.

Food.—Insects, mainly *Hymenoptera*—ants, also caterpillars, beetles, etc.

(12) **Strickland's Chat.** *Œnanthe opistholeuca* Strickland. (F. No. 508).
Abundance.—Not very common; only 4 birds killed on 4-1-1930 and 22, 28, 30-11-1929.
Food.—Insects—mainly *Hymenoptera*, e.g., ants, also beetles, etc.

(13) **The Isabelline Chat.** *Œnanthe isabellina* Cretzschm. (F. No. 512).
Abundance.—Rare: only 1 specimen killed on 28-8-1930.
Food.—Mainly insects.

(14) **The Eastern Indian Redstart.** *Phœnicurus ochrurus rufiventris* Vieill. (F. No. 532).
Abundance.—A common bird, but only a winter visitor; 10 birds killed on 3, 6 (2)-1-1930, 26-1-1928, 9, 15-11-1930, 28-11-1929, 4-12-1930 and 6, 15-12-1929.
Food.—With the exception of one bird the stomach contents consisted of mainly insects—ants and other *Hymenoptera*, caterpillars, beetles, etc.
Status.—Of minor importance to agriculture: beneficial.

(15) **The Western Red-spotted Blue-throat.** *Cyanosylvia suecica suecica* Linn. (F. No. 536).
Abundance.—Rare; only 1 specimen killed on 11-4-1928.
Food.—Mainly insects—ants, cutworms, caterpillars and beetles.

(16) **The Brown-backed Indian Robin.** *Saxicoloides fulicata cambaiensis* Lath. (F. No. 557).
Abundance.—A common and most familiar bird; a permanent resident; 21 birds killed during all the different months of the year.
Food.—Various insects, mostly injurious—*Chrotogonus* spp., locust hoppers, white-ant workers, *Laphygma* sp. and other caterpillars, beetles, ants and other *Hymenoptera.*
Status.—Of major importance to agriculture: beneficial.

(17) **The Black-throated Thrush.** *Turdus atrogularis* Temm. (F. No. 578).
Abundance.—A winter visitor; not very common; 7 birds killed on 20, 21, 25-1-1928, 21-2-1928, 28-2-1930 and 16, 18-3-1930.
Food.—Mainly insects—locust eggs and hoppers, cutworms and other caterpillars, beetles, etc.

Family: MUSCICAPIDÆ.

(18) **The Indian Paradise Flycatcher.** *Terpsiphone paradisi paradisi* Linn. (F. No. 688).
Abundance.—A pair was seen in the summer on 20-6-1928 and a male bird in winter on 25-11-1931.
Food.—Mainly insects.

(19) **The White-browed Fantail Warbler.** *Rhipidura aureola aureola* Less. (F. No. 700).
Abundance.—Not very common, 6 birds were killed on 11-2-1928, 7-8-1929, 23-9-1928, 30-10-1930, and 18, 21-11-1929.
Food.—Mainly insects—*Chrotogonus* spp., ants and beetles.

Family: LANIIDÆ.

(20) **The Indian Grey Shrike.** *Lanius excubitor lahtora* Sykes. (F. No. 706).
Abundance.—Very common; is seen sitting on trees looking for insects on wing or on ground; 13 birds were killed during different months.
Food.—Insects—*Chrotogonus* spp., locust adults and hoppers, black ants and other *Hymenoptera*, *Agrotis* caterpillars, beetles and bugs, etc.
Status.—Of major importance to agriculture: beneficial.

(21) **The Bay-backed Shrike.** *Lanius vittatus* Valenc. (F. No. 710).
Abundance.—Common; 9 birds killed on 15, 20-3-1928, 5-4-1928, 22-5-1929, 3-7-1929, 17-8-1928, 26-11-1929, 14-12-1929 and 1-12-1930.
Food.—Insects—*Chrotogonus* spp., ants and other *Hymenoptera*, *Neuroptera*, cutworms and other caterpillars, beetles, etc.
Status.—Of major importance to agriculture: beneficial.

(22) **The Rufous-backed Shrike.** *Lanius schach erythronotus* Vigors. (F. No. 714).

Abundance.—Common; 4 birds killed on 3-1-1930, 22-3-1930, 26-11-1929 and 23-12-1929.
Food.—Insects—locust hoppers, ants and other *Hymenoptera*, caterpillars, beetles, etc.
Status.—Of minor importance to agriculture: beneficial.

(23) **The Indian Common Wood-Shrike.** *Tephrodornis pondiceriana pondiceriana* Gmel. (F. No. 729).
Abundance.—Rare; only 1 specimen was killed on 29-11-1929.
Food.—Various insects—*Hymenoptera*, *Coleoptera*, etc.

Family: PERICROCOTIDÆ.

(24) **The Indian Short-billed Minivet.** *Pericrocotus brevirostris brevirostris* Vigors. (F. No. 738).
Abundance.—Not common; 6 birds killed on 8-1-1929, 17, 24-2-1928, 20-11 1929 (2) and 4-12-1928.
Food.—Buds of *kikar* (*Acacia arabica*), spiders, various insects—*Orthoptera*, ants and other *Hymenoptera*, caterpillars, beetles, flies, etc.

Family: DICRURIDÆ.

(25) **The Black Drongo** or **King Crow.** *Dicrurus macrocercus macrocercus* Vieill. (F. No. 766).
Abundance.—Most familiar and common bird, found throughout the year; 21 birds killed during all the different months of the year. It is seen perching on telegraph wires, trees, poles, backs of cattle, watching for insects, or sitting on clods in fields which are being irrigated, waiting for insects disturbed by water. It catches flying insects as well as those on the ground.
Food.—Insects—*Chrotogonus* spp., locust adults and hoppers, black ants, white-ants, moths, cutworms, *Laphygma* and other caterpillars, beetles, maggots, etc.
Status.—Very important bird to agriculture: positively beneficial.

Family: SYLVIIDÆ.

(26) **The Indian Tailor-Bird.** *Orthotomus sutorius sutorius* Forst. (F. No. 813).
Abundance.—Not common; 6 birds killed on 14-4-1928, 15-6-1926 (3), 27-7-1926 (2).
Food.—Insects such as flies, bees, etc.

(27) **The Rufous-fronted Wren-Warbler.** *Franklinia buchanani* Blyth. (F. No. 831).
Abundance.—Rare bird; only 2 killed on 7-8-1929 and 4-9-1929.
Food.—Mainly harmful insects.

(28) **The Brown Willow-Warbler.** *Phylloscopus collybitus tristis* Blyth. (F. No. 854).
Abundance.—A winter visitor; only 3 killed on 21-11-1929, 11-12-1929 and 11-12-1930.
Food.—Mainly harmful insects.

(29) **The Green Willow-Warbler.** *Acanthopneuste nitidus nitidus* Blyth. (F. No. 874).
Abundance.—A winter visitor; 3 birds killed on 2, 4-9-1929 and 17-12-1929.
Food.—Mainly insects—caterpillars, etc.

Family: ORIOLIDÆ.

(30) **The Indian Oriole.** *Oriolus oriolus kundoo* Sykes. (F. No. 953).
Abundance.—A rare bird, seen in pairs in gardens; 5 killed on 23-6-1926, 5, 15-7-1928, 26-7-1929 and 14-8-1931.
Food.—Ficus fruits and various insects—*Chrotogonus* spp. caterpillars, etc.

Family: STURNIDÆ.

(31) **The Rosy Pastor** or **Rose coloured Starling.** *Pastor roseus* Linn. (F. No. 972).
Abundance.—Appears in large flocks in the month of April and disappears in the same month, the nestlings visit again in July and remain here upto the first week of October; 76 birds killed during April, August and September.

Food.—Mostly mulberry fruits, ficus fruits, grains of chari (*Andropogon sorghum*) and other similar crops; and various harmful insects—*Chrotogonus* spp., locust adults and hoppers, gram caterpillars and cutworms, other caterpillars, beetles, weevil adults and grubs, dipterous pupæ, etc. It is a great enemy of locust.

Status.—Very beneficial particularly during the locust years.

(32) **The Himalayan Starling.** *Sturnus vulgaris humii* Brooks. (F. No. 973).

Abundance.—Remains in flocks throughout the winter; 89 birds killed from August to April.

Food.—Small quantities of grains, fruits; lizards and spiders; large numbers of harmful insects—*Chrotogonus* spp. all stages of locust, gram caterpillars and cutworms, beetles, weevil and grubs, maggots, and *Chrysopa* sp. pupae. It is a great enemy of the gram caterpillars; one bird took 103 cutworms per meal. Practically all the birds killed had taken gram caterpillars and cutworms.

Status.—A most important bird to agriculture: beneficial.

(33) **The Common Myna.** *Acridotheres tristis tristis* Linn. (F. No. 996).

Abundance.—One of the most familiar and common bird; present in large numbers throughout the year; attends ploughing, hoeing, watering and other agricultural operations, picking up insects which are disturbed. It may be seen going round and peeping into bushes and plants for insects.

Food.—Ripening grains, seeds and seedlings, vegetables and various harmful insects—*Chrotogonus* spp., all stages of locust, ants, winged white-ants, adults of *Amsacta* sp., gram caterpillars, cutworms and other caterpillars, beetles, weevils and weevil grubs (*Hypera variabilis*), etc.

Examination of Stomach Contents.—Cropseeds 38.2 per cent; weedseeds 0.3 per cent; neutral seeds 0.1 per cent; vegetables 5.5 per cent; cultivated fruits 4.9 per cent; wild fruits 29.4 per cent; animal matter 0.7 per cent; injurious insects 20.1 per cent and pebbles 0.8 per cent.

Status.—Very important to agriculture: beneficial.

Family: Ploceidæ.

(34) **The White-throated Munia.** *Uroloncha malabarica* Linn. (F. No. 1030).

Abundance.—Not very common; 4 birds killed on 20-1-1928, 31-3-1928, and 11, 28-11-1930. It is seen sitting on the top of *sarkanda* (*Saccharum spontaneum*), chari (*Andropogon sorghum*) and bajra (*Pennisetum typhoideum*) plants.

Food.—Grains, weedseeds, vegetable matter; and insects—ants, beetles, etc.

Status.—Of minor importance to agriculture: injurious.

Family: Fringillidæ.

(35) **The Yellow-throated Sparrow.** *Gymnoris xanthocollis xanthocollis* Burton (F. No. 1094).

Abundance.—Not very common; 6 birds killed on 16-2-1928, 4-4-1928 (2), 27-4-1931, 8-5-1928 and 27-8-1929.

Food.—Grains, weedseeds, vegetable matter; and insects—ants, beetles, etc.

(36) **The Indian House-Sparrow.** *Passer domesticus indicus* Jard. & Selby. (F. No. 1096).

Abundance.—A permanent resident, found in abundance throughout the year. Attacks in very large flocks the ripening cereals—wheat, chari (*Andropogon sorghum*), bajra (*Pennisetum typhoideum*), and rice (*Oryza sativa*) etc.; 262 birds killed throughout the different months of the year.

Food.—Ripening crops and fruits, tender shoots, flowers, vegetables, weedseeds; in the breeding season insects mostly caterpillars, also ants in small numbers, locust hoppers.

Examination of Stomach Contents.—Cropseeds 73.1 per cent; weedseeds 4.2 per cent; vegetables 0.4 per cent; insects 2.6 per cent; and pebbles 19.7 per cent.

Status.—A very important bird to agriculture: very injurious.

(37) **The Red-headed Bunting.** *Emberiza icterica* Eversm. (F. No. 1134).
Abundance.—Not common; 2 birds killed on 11-4-1928 and 11-12-1930.
Food.—Grains and seeds.

Family: HIRUNDINIDÆ.

(38) **The Common Swallow.** *Hirundo rustica rustica* Linn. (F. No. 1152).
Abundance.—Rare; one bird killed on 25-12-1929.
Food.—Insects.

(39) **The Indian Wire-tailed Swallow.** *Hirundo smithii filifera* Stephens. (F. No. 1157).
Abundance.—Rare bird; was seen on 27-7-1931.
Food.—Insects.

Family: MOTACILLIDÆ.

(40) **The Indian White Wagtail.** *Motacilla alba dukhunensis* Sykes. (F. No. 1166).

Abundance.—Common and remains from September to first week of May; 21 birds killed on 2, 18, 22-1-1928, 2-5-1928, 18 (2), 19-10-1928, 5, 8, 13, 19-11-1928, 21-11-1929, 19, 25, 26, 29-11-1930 and 14, 16-12-1929.

Food.—Mostly insects—*Chrotogonus* spp., ants and other *Hymenoptera*, gram caterpillars, cutworms and other caterpillars, adults and grubs of *Hypera variabilis*. Few birds took grass seeds, grains and weedseeds.

Status.—Of major importance to agriculture: beneficial.

(41) **The Indian Pipit.** *Anthus richardi rufulus* Vieill. (F. No. 1195).

Abundance.—Not very common; 5 birds killed on 20, 27-3-1928, 26-3-1930, 5-4-1928 and 23-12-1929.

Food.—Mainly insects—Orthoptera, locust hoppers, Vespidæ, gram caterpillars and cutworms, beetles, weevils and dipterous pupæ.

Status.—Of some importance to agriculture: beneficial.

Family: ALAUDIDÆ.

(42) **Franklin's Crested Lark.** *Galerida cristata chendoola* Franklin. (F. No. 1237).

Abundance.—Not very common; 5 birds killed on 20, 27-3-1928, 26-3-1930, 17-11-1930, 7-12-1928 and 20-12-1929.

Food.—Grains, weedseeds and insects—locust hoppers, ants, cutworms, etc.

(43) **The Ashy-Crowned Finch-Lark.** *Pyrrhulauda grisea* Scop. (F. No. 1245).

Abundance.—Rare; one bird killed on 25-8-1931.

Food.—Omnivorous, feeds mostly on grains.

Family: NECTARINIIDÆ.

(44) **The Indian Purple Sunbird.** *Leptocoma asiatica asiatica* Lath. (F. No. 1278).

Abundance.—A summer visitor, commonly seen on flowers; 6 birds killed on 29-3-1928 (2), 19-4-1928 and 5, 24, 28-5-1928.

Food.—Mostly honey and insects, also spiders.

Family: PICIDÆ.

(45) **The Northern Golden-backed Woodpecker.** *Brachypternus benghalensis benghalensis* Linn. (F. No. 1394).

Abundance.—A familiar bird, commonly seen climbing on trees; 12 birds killed on 10, 12-3-1928, 10-4-1930, 14, 28-6-1926, 12-7-1928, 19-8-1926 (2), 1-8-1928, 26, 27-11-1929 and 10-12-1928.

Food.—Insects—mostly black ants, *Chrotogonus* spp., grasshoppers, caterpillars, moths, beetles, bugs, etc.

Status.—Of major importance to agriculture: beneficial.

(46) **The European Wryneck.** *Iynx torquilla torquilla* Linn. (F. No. 1423).
Abundance.—Rare; only 1 bird was killed on 26-8-1929.
Food.—Insects.

Family: Cuculidæ.

(47) **The Common Hawk-Cuckoo.** *Hierococcyx varius* Vahl. (F. No. 1458).

Abundance.—Rare; only 3 birds were shot on 9-4-1928, 24-4-1930 and 8-7-1928.

Food.—Insects, many harmful species such as locust hoppers, grasshoppers, winged white-ants, enormous quantity of cutworms, other caterpillars, etc.

(48) **The Pied Crested Cuckoo.** *Clamator jacobinus jacobinus* Bodd. (F. No. 1472).

Abundance.—Rare; only 3 birds killed on 27-6-1929, 1-7-1928 and 22-8-1929.

Food.—Grasshoppers, winged white-ants and other insects.

(49) **The Indian Koel.** *Eudynamis scolopaceus scolopaceus* Linn. (F. No. 1475).

Abundance.—Arrives in the first week of March and remains upto early October; 7 birds killed on 17, 18, 25, 30-6-1926, 24-7-1926, 6-7-1928 and 9-8-1926.

Food.—Mostly ficus fruits and sometimes *Ber* (*Zizyphus jujuba*) and other fruits.

Status.—Of some importance as an enemy of crow's eggs.

(50) **The Common Crow Pheasant** or **Coucal.** *Centropus sinensis sinensis* Stephen. (F. No. 1490).

Abundance.—Not very common; lives in clumps of bamboos and in thick sugar-cane fields; 4 birds killed on 27-3-1928, 30-5-1929 and 30-6-1926 (2).

Food.—Mainly insects, including some noxious species—*Chrotogonus* spp., *Hymenoptera*, gram caterpillars, cutworms, maggots, etc.; also lizards, snakes, mice, bats and eggs of birds.

Status.—Of minor importance to agriculture: beneficial.

Family: Psittacidæ.

(51) **The Large Indian Paroquet.** *Psittacula eupatria nepalensis* Hodgs. (F. No. 1497).

Abundance.—A very common bird, moves about in large parties towards cultivated area in the morning; returns before noon: again leaves in the afternoon and returns in the evening to spend the night at the roosting place.

Food.—A gregarious feeder; attacks various ripening crops specially wheat, maize, chari (*Andropogon sorghum*), toria (*Brassica campestris*), paddy (*Oryza sativa*) etc. and also attacks all kinds of fruits particularly citrus, guavas, figs, etc. It also takes vegetables and weedseeds. Its feeding habits are extremely wasteful as it cuts off much more than it can consume.

Examination of Stomach Contents.—Cropseeds 52 per cent, weedseeds 2.7 per cent; neutral seeds 11.4 per cent, vegetables 4.8 per cent, cultivated fruits 19.3 per cent; wild fruits 9.791 per cent and pebbles 0.009 per cent.

Status.—Of great importance to agriculture and horticulture: extremely harmful.

(52) **The Rose-ringed Paroquet.** *Psittacula krameri manillensis* Bechst. (F. No. 1500).

Abundance.—Same as above.

Food.—Same as above.

Status.—Of great importance to agriculture: extremely harmful.

Family: Coraciidæ.

(53) **The Indian Roller** *Coracias benghalensis benghalensis* Linn. (F. No. 1517).

Abundance.—Very common throughout the year; 19 birds killed during different months. It is seen perching on trees, telegraph wires, poles, and sometimes on the backs of cattle, and dashes for insects in air or on ground, picks up its victim and returns to the perch to eat.

Food.—Insects—*Chrotogonus* spp., crickets, locust adults and hoppers, enormous number of winged white-ants, black ants and other *Hymenoptera*, beetles; also lizards, frogs and mice.

Status.—Very important to agriculture: beneficial.

Family: MEROPIDÆ.

(54) **The Common Indian Bee-eater.** *Merops orientalis orientalis* Lath. (F. No. 1523).

Abundance.—A common bird, arrives in the last week of February and remains here for breeding uptill October; 9 birds killed on 22, 24-2-1928, 8, 27-5-1928, 14, 15-6-1926, 16-6-1931, 6-9-1929 and 7-9-1931.

Food.—Mainly insects—ants, bees, other *Hymenoptera*, dragon flies, moths, beetles, etc.

(55) **The Blue-tailed Bee-eater.** *Merops superciliosus javanicus* Horsf. (F. No. 1526).

Abundance.—Not very common; only 2 birds were killed on 14-7-1931 (2).

Food.—Dragon flies and some other insects.

Family: ALCEDINIDÆ.

(56) **The White-breasted Kingfisher.** *Halcyon smyrnensis smyrnensis* Linn. (F. No. 1550).

Abundance.—Common throughout the year; 17 birds killed during different months.

Food.—Insects—*Chrotogonus* spp., grasshoppers, gryllids, caterpillars, beetles, aquatic bugs, etc.

Status.—Of minor importance to agriculture: beneficial.

Family: UPUPIDÆ.

(57) **The Indian Hoopoe.** *Upupa epops orientalis* Stuart Baker. (F. No. 581).

Abundance.—Common and is generally seen throughout the year haunting grassy and cultivated fields; 21 birds killed during different months.

Food.—Mainly insects—*Forficulidæ*, *Chrotogonus* spp., locust hoppers, ants, gram caterpillars, cutworms and other caterpillars, beetles and beetle grubs, etc.

Status.—Of major importance to agriculture: beneficial.

Family: TYTONIDÆ.

(58) **The Indian Barn-Owl.** *Tyto alba javanica* Gmelin. (F. No. 1636).

Abundance.—Not very common; only 3 birds killed on 9-4-1928, 26-4-1929, and 3-6-1926.

Food.—Mice and insects.

Status.—Of minor importance to agriculture: beneficial.

Family: ASIONIDÆ.

(59) **The Central Indian Collared Scops-Owl.** *Otus bakkamœna marathæ* Ticehurst. (F. No. 1667).

Abundance.—Rare; only 2 birds killed on 11-5-1931 (2).

Food.—Mice; beetles and other insects.

(60) **The Northern Spotted Owlet.** *Athene brama indica* Frankl. (F. No. 1684).

Abundance.—Common throughout the year; 25 birds killed during different months.

Food.—Insects—*Chrotogonus* spp., gryllids, locust adults and hoppers, winged white-ants, ants, caterpillars, moths, beetles, maggots, etc. Its favourite food is beetles and it also takes mice.

Status.—Of major importance to agriculture: beneficial.

Family: ÆGYPIIDÆ.

(61) **The Cinercous Vulture.** *Ægypius monachus* Linn. (F. No. 1705).

Abundance.—Common throughout the year; one was killed on 26-3-1928.

Food.—Flesh of carrion.

Status.—Scavenger.

(62) **The Himalayan Griffon.** *Gyps himalayensis* Hume. (F. No. 1709).

Abundance.—Not common; only 1 was killed on 9-1-1930.

Food.—Carrion; dung; and insects such as locust hoppers.

Status.—Scavenger.

Family: FALCONIDÆ.

(63) **The Laggar Falcon.** *Falco jugger* Gray. (F. No. 1721).
Abundance.—Rare; only 3 birds killed on 5-1-1929, 29-3-1928, and 11-4-1929.
Food.—Pigeons and other birds; locust and other insects.
Status.—Enemy of birds.

(64) **The Red-headed Merlin.** *Falco chiquera chiquera* Dauden. (F. No. 1730).
Abundance.—Rare; only 2 specimens killed on 4-1-1929 and 16-3-1928.
Food.—Birds; locusts, other insects.
Status.—Enemy of birds.

(65) **The Eastern Steppe-Eagle.** *Aquila nipalensis nipalensis* Hodgs. (F. No. 1748).
Abundance.—Rare; only 1 specimen was killed on 9-1-1929.
Food.—Small mammals, birds and reptiles.

(66) **The White-eyed Buzzard-Eagle.** *Butastur teesa* Frankl. (F. No. 1774).
Abundance.—Not very common; only 3 birds killed on 26-3-1928, 4-5-1928 and 14-6-1929.
Food.—Mice; various harmful insects—*Chrotogonus* spp., rice grasshopper, gryllids, caterpillars, beetles, etc.
Status.—Of minor importance to agriculture.

(67) **The Common Pariah Kite.** *Milvus migrans govinda* Sykes. (F. No. 1787).
Abundance.—Very common throughout the year; 3 birds killed on 4-1-1929, 15-3-1930 and 15-4-1930.
Food.—Kitchen and animal refuse, mice, lizards, small birds, chickens; various insects such as locust adults and hoppers.
Status.—Of major importance to agriculture: injurious to poultry.

(68) **The Indian Shikra.** *Astur badius dussumieri* Temm. (F. No. 1803).
Abundance.—Not very common; 6 birds killed on 28-4-1930, 26-6-1926, 30-7-1926, 2, 9-8-1926 and 10-11-1926.
Food.—Pigeons and other birds, mice, rats, lizards; and insects such as mantids, locust hoppers and adults, grasshoppers, winged white ants, etc.

(69) **The Northern Besra Sparrow-Hawk.** *Accipiter virgatus affinis* Hodgs. (F. No. 1814).
Abundance.—Not very common; 3 birds killed on 14-1-1929, 19-3-1930 and 28-4-1930.
Food.—Birds, lizards and insects such as locust.

Family: COLUMBIDÆ.

(70) **The Bengal Green Pigeon.** *Crocopus phœnicopterus phœnicopterus* Lath. (F. No. 1826).
Abundance.—Rare bird; only a few birds were seen in King's garden on 10-9-1931, but could not be killed.
Food.—Mostly ficus fruits.

(71) **The Indian Blue Rock-Pigeon.** *Columba livia intermedia* Strick. (F. No. 1856).
Abundance.—A very common bird, congregates in very large flocks and roosts in buildings—dwelling houses, mosques, temples and offices; leaves roosting places in the morning and returns before noon and again leaves in the afternoon and returns in the evening. On its return it visits tanks to drink water.
Food.—Takes food as gleanings, picks up seeds of crops especially wheat and maize, germinating crops, weedseeds and pebbles.
Examination of Stomach Contents.—Cropseeds 66.15 per cent; weedseeds 30 per cent and pebbles 3.85 per cent.
Status.—Of major importance to agriculture: very injurious.

(72) **The Indian Spotted Dove.** *Streptopelia chinensis suratensis* Gmel. (F. No. 1873).
Abundance.—A rare bird; two pairs seen since 1926 and 1 bird killed on 20-1-1929.
Food.—Grains, weedseeds and fruits.

(73) **The Indian Little Brown Dove.** *Streptopelia senegalensis cambaiensis* Gmelin. (F. No. 1877).

Abundance.—Common, found throughout the year; 14 birds killed during different months.

Food.—Grains, weedseeds, seeds sown, germinating crops and pebbles.

Status.—Of minor importanec to agriculture: injurious.

(74) **The Indian Ring=Dove.** *Streptopelia decaocta decaocta* Frivalszky. (F. No. 1879).

Abundance.—Very common throughout the year. At the time of thrashing of toria (*Brassica campestris*) seen in abundance in such fields.

Food.—Grains as gleanings, seeds sown and germinating crops, pebbles Only two or three birds took one insect each.

Examination of Stomach Contents.—Cropseeds 64.97 per cent; weedseeds 30.58 per cent; vegetable matter 1.18 per cent; insects 0.06 per cent and pebbles 3.21 per cent.

Status.—Of major importance to agriculture: injurious.

(75) **The Indian Red Turtle=Dove.** *Œnopopelia tranquebarica tranquebarica* Henry. (F. No. 1881).

Abundance.—A summer visitor; 6 birds killed on 7-5-1931 (2), 16-6-1931, 19-8-1928 (2) and 8-8-1929.

Food.—Same as above.

Status.—Of minor importance to agriculture: injurious.

Family: PTEROCLIDÆ.

(76) **The Common Indian Sand=Grouse.** *Pterocles exustus erlangeri* Neum. (F. No. 1893).

Abundance.—A rare bird; a few were seen on barren land near Narwala in August, 1929.

Food.—*Guara* (*Cyamopsis psoralioides*) seeds and other grains.

Family: PHASIANIDÆ.

(77) **The Common Peafowl.** *Pavo cristatus* Linn. (F. No. 1897).

Abundance.—Introduced; eggs brought from Hoshiarpur; only 1 or 2 birds seen in the King's garden.

Food.—Grains, vegetables, fruits; insects such as locust hoppers, caterpillars, beetles, etc.; also takes frogs, lizards and snakes.

(78) **The Common** or **Grey Quail.** *Coturnix coturnix coturnix* Linn. (F. No. 1950).

Abundance.—Visits in very large numbers in April and August to September; 16 birds killed on 14-3-1927 (2), 14-4-1928, 3-9-1929 (3) and 11 (5), 13 (5),-9-1931.

Food.—Grains, weedseeds, insects—ants, caterpillars, *Hypera variabilis* grubs, beetles, aphids, etc.

(79) **The Northern Chukar.** *Alectoris græca pallescens* Hume. (F. No. 1974).

Abundance.—Not found in open country, but kept as a cage bird.

Food.—Omnivorous.

(80) **The Indian Black Partridge.** *Francolinus francolinus asiæ* Bonap. (F. No. 1976).

Abundance.—Not found in the open country, but is a favourite cage bird.

Food.—Grains, weedseeds; and various insects such as locust hoppers, etc.

(81) **The Northern Grey Partridge.** *Francolinus pondicerianus interpositus* Hartert. (F. No. 1984).

Abundance.—Rare; 10 birds killed on 27-3-1930, 2-4-1930 (2), 12, 26-6-1926 and 4 (2), 17, 21, 24-7-1928.

Food.—Grains, seeds, weedseeds, vegetable matter; and insects—locust hoppers, ants, winged white-ants and workers, beetle grubs, etc.

Status.—Of major importance to agriculture: beneficial.

Family: TURNICIDÆ.

(82) **The Little Button=Quail.** *Turnix dussumieri* Temm. (F. No. 2003).

Abundance.—Rare; only 1 bird was shot on 14-4-1928.

Food.—Grains, weedseeds and insects.

Family: RALLIDÆ.

(83) **The Coot.** *Fulica atra atra* Linn. (F. No. 2029).
Abundance.—Rare; only 1 specimen was shot on 16-2-1928.
Food.—Germinating crops and insects.

Family: GLAREOLIDÆ.

(84) **The Cream-Coloured Courser.** *Cursorius cursor cursor* Latham. (F. No. 2051).
Abundance.—Rare; 6 specimens shot on 13-2-1930 and 4 (2), 8 (3)-12-1929.
Food.—Ants and other *Hymenoptera,* gram caterpillars and other caterpillars, beetles, etc.

Family: STERNIDÆ.

(85) **The Gull-billed Tern.** *Gelochelidon nilotica nilotica* Gmelin. (F. No. 2072).
Abundance.—Rare; 2 specimens killed on 11-8-1931 (2).
Food.—Frogs, *Crustacea* and insects.

Family: CHARADRIIDÆ.

(86) **The Chinese Little Ringed Plover.** *Charadrius dubius dubius* Scop. (F. No. 2113).
Abundance.—Rare; 2 birds killed on 19-3-1930 (2).
Food.—Insects—*Chrotogonus* spp., *Hypera variabilis* grubs, beetles, etc.

(87) **The Indian Red-wattled Lapwing.** *Lobivanellus indicus indicus* Bodd. (F. No. 2125).
Abundance.—Not common, although a permanent resident; 6 birds killed on 11-1-1928, 15-3-1928, 13-8-1928 (2), 27-10-1926 and 8-12-1928.
Food.—Insects—ants, caterpillars, beetles, etc. Two birds took green vegetable matter.

(88) **The Yellow-wattled Lapwing.** *Lobipluvia malabarica* Bodd. (F. No. 2128).
Abundance.—Rare and was seen in August, 1928.
Food.—Insects.

Family: SCOLOPACIDÆ.

(89) **The Green Sandpiper.** *Tringa ochrophus* Linn. (F. No. 2143).
Abundance.—Not very common, is seen near tanks; 7 birds killed on 7 (2) 19 (2)-8-1926, 28, 29-8-1928 and 5-11-1926.

Food.—Mosquitoe larvae and other un-identifiable insects.

(90) **The Ruff and Reeve.** *Philomachus pugnax* Linn. (F. No. 2152).
Abundance.—A rare bird; only 3 specimens killed on 13-8-1928 (2) and 29-11-1929.
Food.—Insects—*Hymenoptera*, beetles and mosquitoe larvae and pupae, etc.

Family: ARDEIDÆ.

(91) **The Cattle Egret.** *Bubulcus ibis coromandus* Bodd. (F. No. 2226).
Abundance.—Rare bird, was seen in flocks twice or thrice attending cattle; 4 birds killed on 29-7-1928 (2) and 7-9-1929 (2).
Food.—Insects—*Chrotogonus* spp., grasshoppers, beetles, etc. Two birds took lizards and one bird took one frog.
Status.—Of minor importance to agriculture: beneficial.

(92) **The Indian Pond-Heron.** *Ardeola grayii* Sykes. (F. No. 2229).
Abundance.—Common near ponds and watered fields, permanent resident; 8 birds killed on 13-1-1928, 10, 16-2-1928, 19-6-1926, 7-8-1926, 18-8-1931, 16-10-1928 and 7-11-1930.
Food.—Insects—*Chrotogonus* spp., grasshoppers, crickets, earwigs, *Hymenoptera* (e.g., ants), caterpillars, beetles, etc.; and also took spider, fish and frog.

(93) **The Night Heron.** *Nycticorax nycticorax nycticorax* Linn. (F. No. 2233).
Abundance.—Rare; only 1 specimen was shot on 29-8-1929.
Food.—Fish, frogs, *Crustacea* and insects.

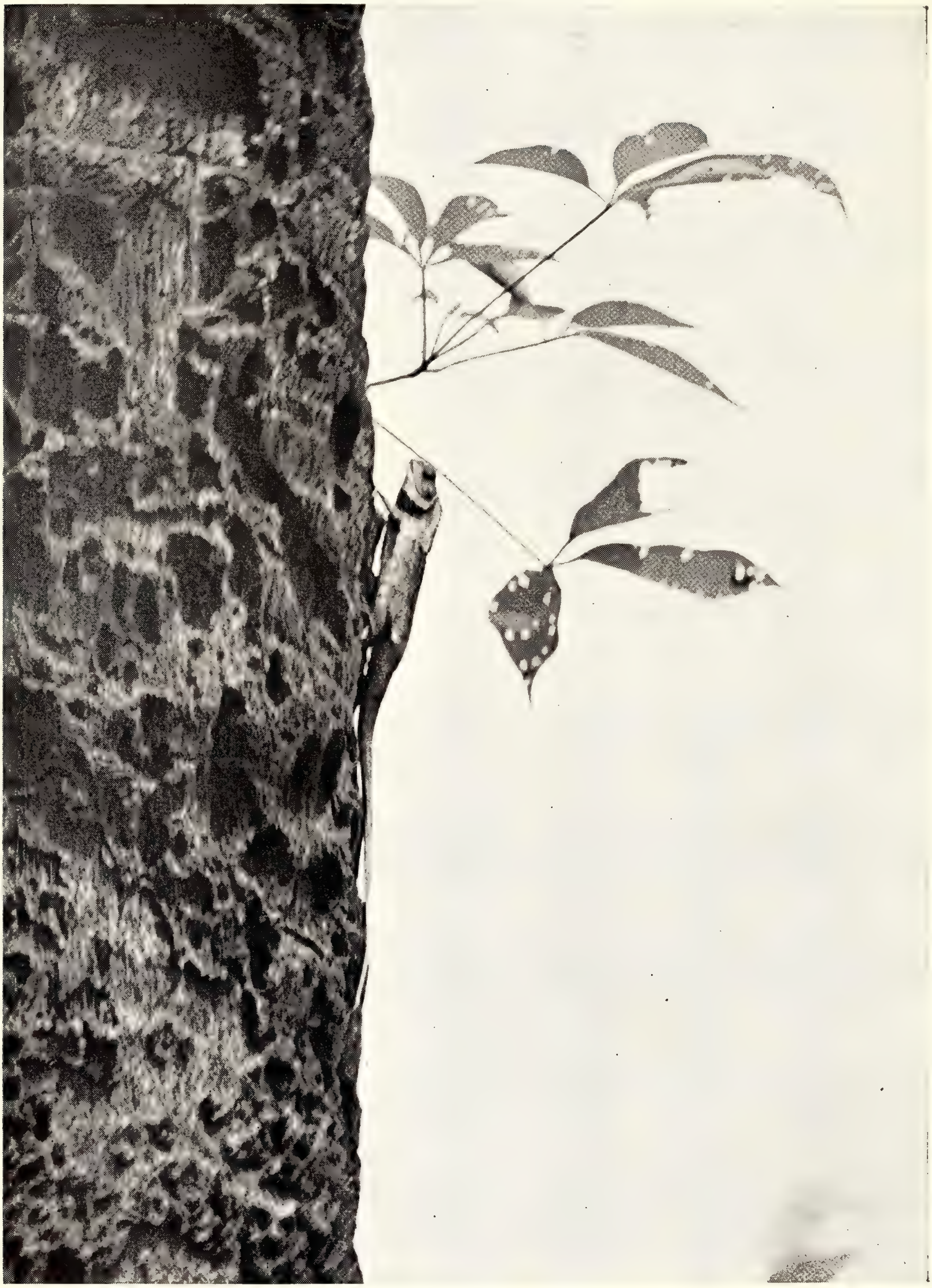

Photo: *C. McCann.*

The Bloodsucker (*Calotes versicolor*). A large male.

NOTES ON *CALOTES VERSICOLOR* (DAUDIN) JERDON.

BY

CHARLES McCANN, F.L.S.

(*With 3 plates*).

The BLOODSUCKER is so common an inhabitant of almost every garden in India, that it is frequently referred to as the 'garden lizard'. How it ever came by the name of Bloodsucker is difficult to say, for it could not 'suck' even if it would; and the choice of this name is certainly more unfortunate than that of 'chameleon' which is commonly used for this lizard by the Europeans in Indo-China. This *Calotes* is not the Chameleon, but it is rightfully entitled to its specific designation *versicolor* or 'colour-changing', because it can change its colour to some extent under ordinary circumstances, and does change it very much during the breeding season.

As a rule the Bloodsucker, either male or female, is by no means conspicuous. Not that it remains in hiding, for it takes keen delight in warmth and light and may be seen in the open basking in the morning sun, on the alert for some unwary prey. Light brown or greyish, with or without a greenish tinge and indistinct dark spots or streaks, its colour easily blends with the varied hues of the surroundings, while the general outline and the peculiar favourite attitude assumed when at rest further contribute to render the animal invisible to all but experienced eyes.

During the cold season bloodsuckers seek shelter in hollow trunks or holes in the ground, or enter houses where they hide behind furniture and curtains. They only emerge from their retreat during the hottest part of the day to bask in the sun and indulge in short spell of exercise. As the weather becomes genial and warmer they come out more often, until finally they settle down for good in the open where they spend the summer months.

The breeding season is heralded by a remarkable change of colour. While the female is satisfied with a slight maidenly blush, the male dons the most extraordinary polychromous attire, the head, the shoulders, a portion behind the shoulders, and a part of the forelegs become brilliant crimson or bright scarlet; black patches appear on either side of the throat, at the angle of the jaw, and the shoulder.

Thus grotesquely, some say gorgeously, painted the male sits on a fence post or on the trunk of a tree surveying the neighbourhood. By now its manners are as loud as its dress, and its sole intent is to seek a quarrel. It will from time to time distend its gular membrane and jerk its head and shoulders up and down, as an acrobat practising the 'dunds' by way of exercise. But this is not a mere physical exercise, it is to all intents and purposes a provocation, a challenge to all the males in the vicinity. And as every male is now urged by the same pugnacious spirit many fights take place with much 'all-in' wrestling and biting.

Two males about to fight will first charge each other from a distance as did the warriors of old. They then gradually approach and finally rush at one another for the grip. On meeting, both stand on the hind legs and tail, hold each other with the forelegs and endeavour to bite. Toes or a portion of the tail are often bitten off in the encounter; and a number of scratches and wounds on various parts of the body certify to the vigour of the combat. However, even with lizards, there is such a thing as shamming; and, very often the fight stops abruptly as one of the duellists believes that flight is safer than fury and runs away before much damage has been done. The victor asserts his territorial rights and becomes the uncontested monarch of all he surveys.

Sexual variation:—Except for the remarkable difference of colour during the breeding season this lizard exhibits little sexual variation. It may, however, be noted that the adult male is appreciably larger than the female, that in the adult male the base of the tail is markedly swollen, and that owing to the presence of larger muscles the lower jaw of the male forms a characteristic curve while that of the female runs in an almost straight line.

Sexual activity:—The breeding season starts in April and ends in September. Mating is frequent from the second half of April to the end of June and the early part of July.

[Annandale (1900) has given an account of the courtship of this lizard. He says that 'The males are very pugnacious and change colour as they fight. At the time of courtship a curious performance is gone through by the male, the female remaining concealed in the foliage hard by. He chooses some convenient and conspicuous station and advances slowly towards the female. His colour then is pale yellowish flesh-colour, with a conspicuous dark spot on the gular pouch, which is extended to its utmost. He stands upright, raising the fore-part of the body as high as possible and nodding his head solemnly up and down. As he does so, the mouth is rapidly and repeatedly opened and shut. When he is driven away, caught or killed, the dark spot disappears entirely from the neck. If one male is captured another takes his place in a few hours.' [*F.B.I.* (*Reptilia*), 2nd. ed., p. 192.]

Dr. Annandale's mention of the total disappearance of the dark spot on the gular pouch needs explanation. There are two such black spots, one on either side of the neck; they are usually clearly defined, and particularly so during the breeding season. When the gular pouch is distended these spots are very conspicuous, often showing a narrow white ring around; but, and this is the point to be emphasized, on contraction of the pouch—as is the case with fear and death—they disappear into the folds of the neck and become invisible. This is evidently what Dr. Annandale meant; for he must have been aware of the existence of pigmented cells and of the persistence of the pigment, even after death. As a matter of fact the old spirit specimens found in the collections of the Bombay Natural History Society still show the spots.

As for the bowings and noddings of the head they may be observed at all times and can be produced by other emotions as well as by sexual excitement. If disturbed, bloodsuckers will bow and nod their heads exactly as when courting. Personally I believe it is a threatening attitude which serves the animal for purposes both offensive and defensive. On the other hand Father Caius is of the opinion that this bowing and nodding is primarily due to the peculiar anatomical structure of the fore-limbs which makes it impossible for the lizard to erect its head and the fore-part of its body for any length of time.

Pairing takes place either on the ground or on the vertical trunk of some tree. At the time of mating the male grips the female with his jaws by the ridge at the back of her neck and, while tightening his embrace, shoots his tail and the posterior end of his body under her. Within a second copulation is over and the animals have separated.

I am indebted to Mr. Sālim Ali for the following account of a pairing which occurred at Kihim on the 12th June 1930.—'After copulation the male ran off some distance and climbed half way up a post; while the female crawled away slowly in aimless fashion, her gait being strikingly similar to that of a walking chameleon. She retained her colour (bright orange-red with two blue-black patches under the neck where the fore-limbs join the body). Not so the male who turned quite pale and only retained the blue-black patches, though in a very much attenuated hue. The female kept crawling about for some twenty minutes, when she was seen to put her nose to the ground as if scenting, and then scratching the earth with only one forepaw at a time. As she was thus engaged the male popped up from behind a stone near by; he was still pale, but as he closed upon her his colours became gradually more vivid and were again quite intense by the time he grabbed her by the neck. She now dragged him to the trunk of a neighbouring mango tree and pulled him up some two feet above the ground, when she surrendered for the second time. After separating the pair remained on the trunk, a few inches apart; the male almost colourless, the female as bright as ever. In another twenty minutes the animals copulated for the third time; the male, completely colourless by now, ran some way up the tree; and the female climbed down to the ground, crawled about for a bit—when she again put her nose down and halted at the place where she had previously pawed, and finally ran half-way up the pole where the male had taken up his position after the first act.'

Egg-laying:—In gardens, the favourite sites for the deposition of eggs are flower beds, flower pots and manure heaps, where the earth is easily scratched out. Away from gardens, any spot where the earth is soft is selected as a suitable site. The 'nest' may be just a trough or a hole from 2 to 7 inches deep, though shallow holes are more frequently selected. When laid in a trough, the eggs are loosely packed; but if in a hole, they are tightly rammed, and this often results in the alteration of their shape. I have repeatedly unearthed eggs, but have never seen actual deposition in progress. However, my neighbour, Mrs. C. Mason, who witnessed a Bloodsucker laying her eggs, described it as follows: 'The lizard came down from the garden wall, went straight to a flower bed, scooped a hole in the earth 3-4 inches deep with her forelegs. She then sat on the edge of the scoop and dropped the eggs in one by one. After a few eggs had been laid, I went closer to watch the proceedings, but the lizard took fright and ran away leaving the eggs uncovered. I counted six eggs and withdrew to a point from which I could observe without being seen. Soon, the lizard returned and completed her egg-laying. When she had finished, she covered over the eggs with earth, smoothed the surface out so as to defy detection and went away. The time taken by the lizard was two hours (including the disturbance) —from 12.30 to 2.30 p.m.' Mrs. Mason marked the spot with a stone and told me about the occurrence the same evening. A week later I dug up the spot only to find the shells left, as ants had eaten the contents. The incident referred to above occurred on the 23rd July (1937). Prior to this, I found 17 eggs in almost the identical spot, on the 24th June.

Eggs:—The eggs are small ellipsoid bodies with a soft chalky white shell. They are not stuck together as is often the case with reptile eggs. When freshly taken from the 'nest' the shape may vary somewhat from the ellipsoid but this is due to pressure as they are frequently tightly packed, but when allowed to stand for a while they become elliptic once more. Eggs from different clutches vary considerably in size but those of the same clutch are fairly regular. On the 22nd August (1937), I dug out two clutches, one of 21 eggs and another of 18. The average measurements of the former were 16.8 × 12.6 mm. (largest 19 × 13 mm., smallest 15 × 12 mm.), and of the latter, 12.4 × 8.3 mm. (largest 13.5 × 9 mm., smallest 11.5 × 9 mm.). These measurements are not in accordance with those recorded by Asana (10-11 × 5.4 mm.) nor with those mentioned by Dr. Malcolm Smith in the *F.B.I., Reptilia,* 2nd. ed., vol. ii, p. 193 (14-15 mm. long by 8-9 mm. broad). However, this only shows the great variation in size and I am in full agreement with Dr. Smith's remark 'the age and size of the parent are important factors in egg-production'. Eggs kept under observation increased 2-3 mm. in size just before the young hatched out. Eggs on being placed in preservatives shrink considerably.

Again, with regard to the number of eggs deposited at a time there seems to be a conflict of opinion. The largest number of eggs I have found in a clutch is 23. Above I referred to two clutches, one of 21 and the other of 18. On the 23rd August (1937) I obtained another clutch of 14 in my garden and a couple of days later a clutch of 15. So far I have never come on a clutch of less than 8. Dr. Smith (*loc. cit*) writes 'I have never known them to be buried more than a couple of inches below the earth, and the number deposited may vary from 4 to 12.' I am

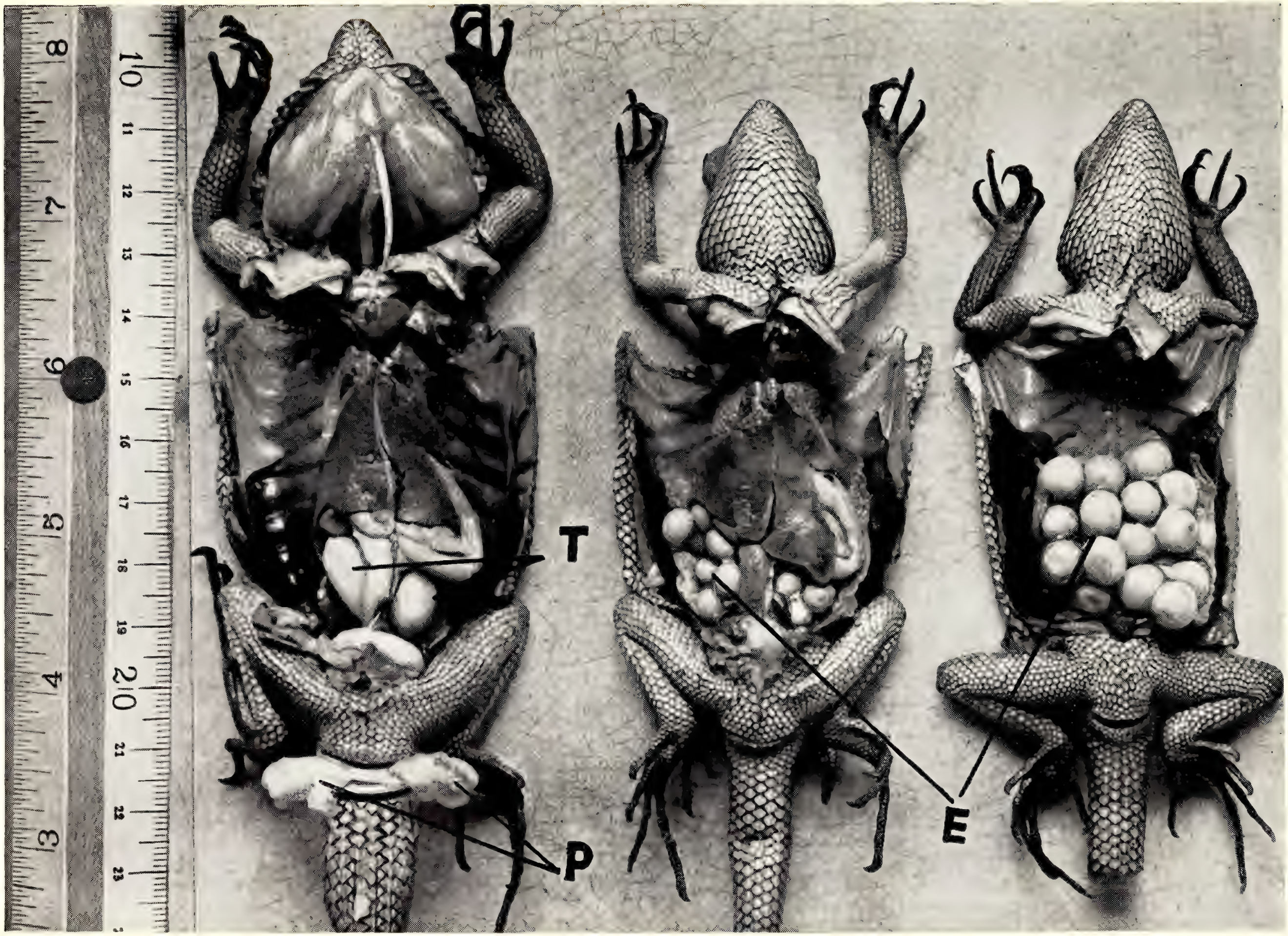
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Photo. C. McCann.

The Bloodsucker (*Calotes versicolor*). Dissections showing condition of the reproductive organs in June.
E. eggs; P. hemipenis, T. testes. (*Scale in millimetres and inches*).

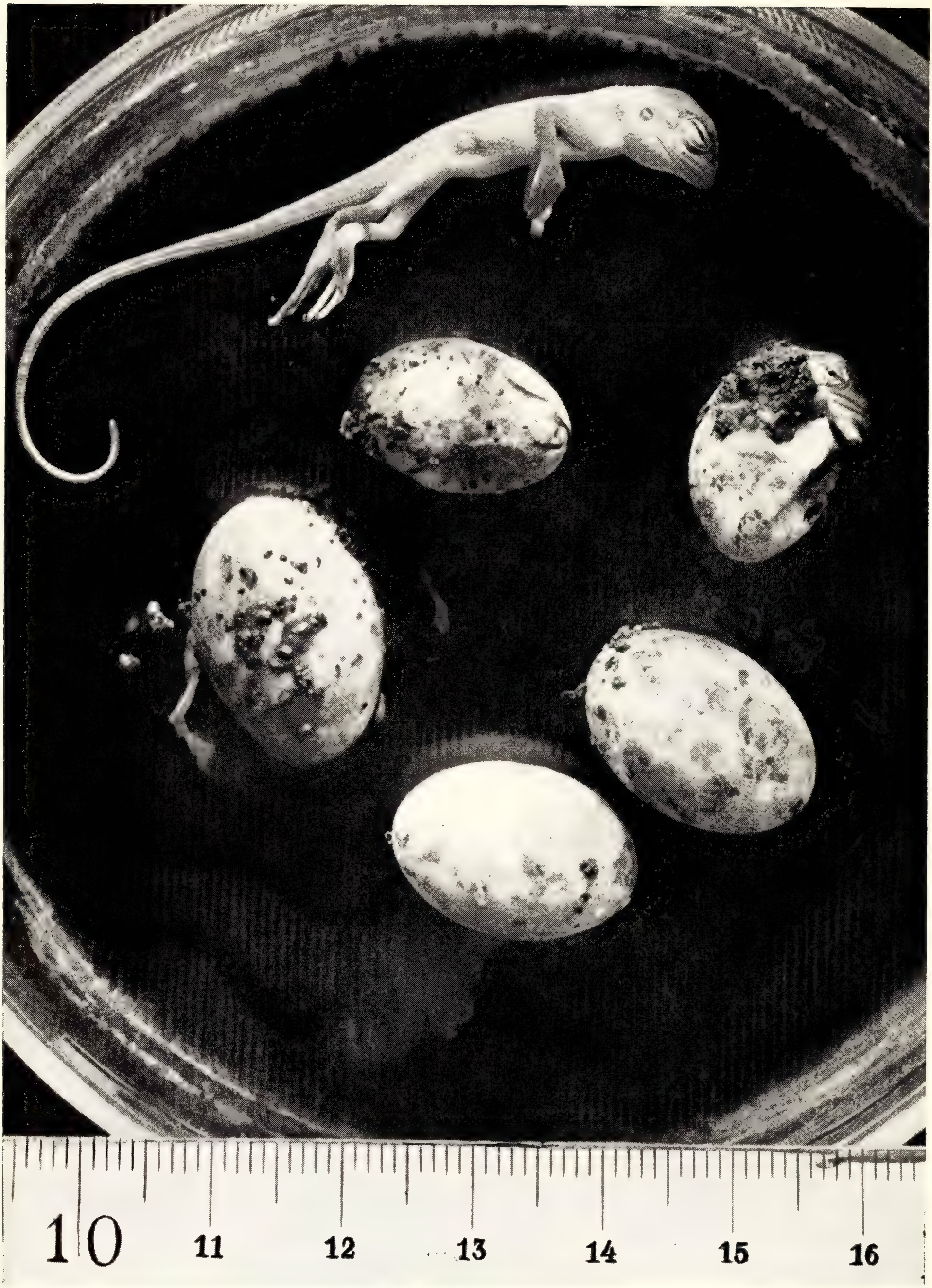
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Photo: *C. McCann.*

The Bloodsucker (*Calotes versicolor*) showing eggs:—hatching and newly hatched. (*Scale in millimetres*).

inclined to believe that a single female lays more than the recorded number of eggs in one season, as dissected females show many more eggs in the ovaries; but all these eggs do not mature at once, and consequently are not laid at the same time. Perhaps the first clutch is the largest and subsequent clutches are smaller. On the 14th October (1937) I obtained 3 further clutches of largish eggs with embryos of various age. The freshest had embryos about one-third incubated. However this point needs further observation.

Incubation:—On the 24th June (1937) Mrs. Mason saw a Bloodsucker covering up her eggs in a flower bed and informed me of it. I dug up 17 eggs from the spot and kept them to hatch out. On the 31st July (37 days) two young hatched out. The next day (38 days) the greater number hatched and the day after (39 days) all were out, with the exception of one egg which was bad. This gives us a period of 37-39 days. Prof. Asana, in his interesting article on the Natural History of *Calotes versicolor,* writes 'The majority of the eggs that have been thus treated in our laboratory hatched after of period of not less than 42 nor more than 45 days.' There is a difference of a week between the two observations, but this appears to me a trivial point as climatic conditions probably influence the period of incubation.

When hatching, the young lizard cuts several irregular and oblique slits in the thin shell at one pole. F. E. W. Venning in an interesting note published in vol. xxi, p. 690 [Some notes on the hatching of the agamoid Lizard (*Calotes jerdoni*)] states that he observed an egg-tooth in the case of the species described. Replying to Venning's note Dr. Annandale (xxi, p. 1099) The Rupture of the Egg-shell in the Genus *Calotes* writes 'but I can find no trace of an egg-tooth in my specimens (*Calotes nigrilabris*), and indeed, it is hard to see how a structure of that nature could produce the oblique slits and triangular flaps so clearly shown in his (Venning's) figures. My own opinon is that the slits are produced by the long claws of the forefoot.'

I have examined several embryos of *Calotes versicolor* at different stages, including the young lizards about to cut the shell and I can find no trace of an egg-tooth. The shells are split open by the claws as suggested by Dr. Annandale. It seems curious that in two species of the same genus no egg-tooth has been observed while in *C. jerdoni* it has been seen (above).

Method of artificial hatching:—On several occasions I have hatched out Bloodsuckers' eggs with varying degrees of success. My failures I attribute to inadequate methods. After several experiments I have found the following method most efficient also for snake eggs and on the whole have had almost cent per cent. success with it. It is this:—Place the eggs on a bed of damp (not wet) earth in a Petric dish; place the dish in an ordinary glass desiccator, the bottom of which is half-filled with water. Now put on the lid leaving it slightly open to allow air to circulate. Leave the whole in a convenient place till hatching is complete. This method prevents the eggs from drying—the chief cause of failures—they remain perfectly terse. It is also a convenient way as the eggs can be watched without distributing them too much.

Newly hatched young:—As soon as the shell is split and the hatchling is able to put its head out it does so. In this position it remains for a considerable time. It will now and then open its eyes and shut them again as though in sleep. From time to time it wriggles in the shell and the surplus embryonic fluid oozes out. Eventually it leaves the shell with the remains of the 'naval cord' still adhering. This is soon rubbed of. On emergence the little lizards are extremely active. A day before the lizard was due I opened an egg and measured it. This specimen measured 72 mm. Another after hatching measured 76 mm. Of course, these measurements are only given to show the approximate size of the young after hatching and probably the young from differently sized eggs would also vary a bit. At birth, the young lizards are yellow in tone with a metallic lustre and with two longitudinal stripes on either side of the crest and with several darker transverse markings. The young maintain these patterns for a considerable period, but the intensity and brilliancy of the markings depend greatly on environment.

Food:—The Bloodsucker is mainly insectivorous, but to this it adds birds' eggs and nestlings during the seasons. For this statement I have had ample evidence. In vol. xxxix, p. 640, Mr. C. H. Biddulph records a Bloodsucker catching a lark. Small lizards and small frogs that it can overpower are also eaten. Earthworms and tiny crabs are also taken.

Enemies:—The enemy cycle of the Bloodsucker is a wide one. Among the mammals cats, even domestic cats, often eat them. Mungooses prey largely on these lizards when the latter are on the ground or in small bushes. I have frequently seen the Common Mungoose (*Herpestes mungo*) catching them. Among the birds, the Bloodsucker has a host of enemies. The smaller birds of prey feed largely on them. Crows, egrets and herons, even the domestic fowls feed on them. The Bull-frog will take those that it can overpower. Snakes, particularly arboreal species, feed largely on these lizards.

Ants and earthworms destroy the eggs.

Parasites:—I have occasionally found ticks between the scales, but perhaps the most harmful parasites are internal. On dissection I have frequently taken Nematodes between 2-3 inches long from the stomach and smaller species from the rectum. In some instances these have been many in a single individual. From the lungs I have taken what appeared to be the maggots of flies. In one case I found one such larva in each lung. The maggots were large measuring about an inch and a quarter when dead. The nasal passage is often choked by the presence of fly larvæ.

Agricultural:—From an agricultural aspect, the Bloodsucker is a most useful animal, destroying numerous insect pests.

REVIEW

I. SOME BEAUTIFUL INDIAN TREES, By The Late Rev. E. Blatter, S.J., Ph.D., F.L.S. and Walter S. Millard. Illustrated with 31 coloured and 37 black and white plates. Price Rs. 15. Published by The Bombay Natural History Society, 6, Apollo Street, Bombay.

A series of articles on Beautiful Flowering Trees which appeared originally in the *Journal* of the Bombay Natural History Society elicited at the time a more than ordinary interest in a large circle of appreciative readers. Not all of these were botanists and men of science; many, in fact most of them, were just ordinary people fond of gardening, perhaps, and with an eye for nature's many-coloured beflowered garb, and for these the articles had a special appeal inasmuch as they were enabled to know more intimately what they already admired, without being first submerged in a sea of scientific technicalities and impressively unintelligible names.

These articles, revised and partly rewritten are now published in book form under the title of *Some Beautiful Indian Trees.* This title calls for a word of explanation. The beautiful trees which adorn so many of the pages in this book are not all of them indigenous to India, in fact the majority of them have been introduced at one time or another from outside, but, whatever their origin, they are now commonly to be found in this country and they share one common characteristic: they are every one of them beautiful. Nor are their names insignificant: consider the Noble Amherstia, the Gul Mohur, the Flame of the Forest, the Rusty Shield Bearer, the Scarlet Bell Tree: what a wealth of colour and variety these names conjure up! Then there are others less 'flamboyant', suggestive rather of a *frail* æsthetic beauty: the Sacred Barna, the Lignum Vitae, the Sacred Asoka Tree which, according to Hindu mythology, is the symbol of love and dedicated to Karma.

The book contains 31 coloured illustrations and 37 black and white plates, each one a tribute to the painstaking efforts of artists and photographers alike. The coloured plates are all reproductions from hand-painted water colours and are remarkable alike for beauty of colouring and the minute attention to detail which is evident throughout. Here you will find the complete life-story of 39 beautiful trees told in plain, simple language with hints for the gardener and particulars of each tree's domestic uses, medicinal properties, and sacred significance. The average reader will find here more information, and that more easily digestible, than he would probably expect, and one cannot but admire the team work which has made the publication of this attractive book possible. Artists, scientists and others have given of their time and knowledge unstintingly, and it is gratifying to know that all but two of them have lived to see the task completed. Of these two, Sister Mary Chiona was responsible for ten of the original water colours, and Fr. Blatter with his profound knowledge of Botany made this book itself possible. In acknowledgment of their unselfish collaboration the book is, very fittingly, dedicated to them.

J. F. C.

MISCELLANEOUS NOTES

I.—SMOKING A PANTHER TO DEATH.

I was interested to read in the last issue of the *Journal* the account of the smoking of a tiger to death. I had a similar experience, years ago, in one of my Shikar trips when a panther was unwittingly smoked to death.

The year and the date I cannot exactly remember and at present I cannot refer to my diaries; but it was about 37 years ago when I was staying at the hill fort of Sinhgar near Poona for the summer. There are in the jungle near about small panthers and other wild animals. One day, when we were out shooting, a small panther was observed in the beat and was tracked by its pugmarks to a small cave. In order to dislodge him, we smoked the cave at one end, the guns being posted at the other. As the panther did not come out, it was thought that the animal had lodged itself near the opposite opening of the tunnel, which also was smoked. After a little while a gasping sound was heard from within. The expert tracker with us said that it was the death-gasp of the panther. We wanted to go in to see what had happened, but the son of the shikari, who was watching the proceedings from the top of a tree became suddenly possessed by the local deity and ordered the people to desist from entering the cave until the next morning. It was sound practical advice which we obeyed. No watch was kept at the cave. We did not believe the story of the shikari, but next day, to our surprise, the villagers, in the company of one of the guns, went into the cave and dragged out the carcase which they brought to the fort where I was staying then. If I remember rightly the above incident was reported in the local Poona English papers of the day.

Camp Madhavgiri,

Ajra, CHIEF OF ICHALKARANJI.

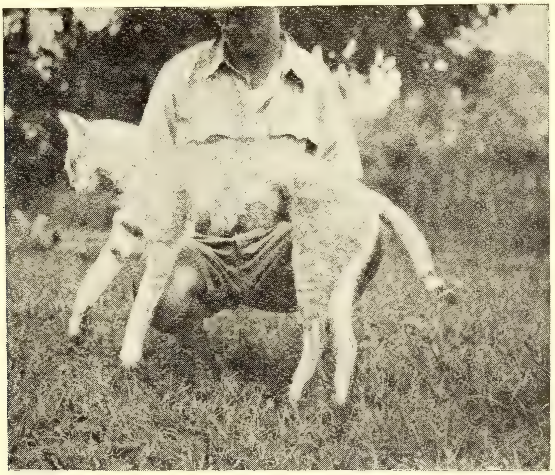
May 11, 1937.

II.—THE SIZE OF THE JUNGLE CAT (*FELIS CHAUS AFFINIS*).

In the Society's *Journal,* vol. xxxvii, No. 4, under the heading of 'The Wild Animals of the Indian Empire', I observe that the Jungle Cat is recorded as being 'Head and body about 2 ft. in length; tail 9 in.' During the last few months I have shot three of these cats near my bungalow, where they have been in the habit of raiding my ducks and pheasants. I give the measurements herewith:

Feb. 18th.	Male.	Head and body 2 ft. 6 in.	Tail 10 in.
May 26th.	Male.	Head and body 2 ft. 1¾ in.	Tail 10½ in.
June 10th.	Male.	Head and body 2 ft. 6¼ in.	Tail 11 in.

I would be very interested to hear if the size of these cats is at all unusual, and if the last mentioned one is anything approaching a record. The measurements were taken as soon as the animals were shot, and from peg to peg.



The Jungle Cat (*Felis chaus affinis*).

I do not think the Jungle Cat is particularly common in Assam, but there are quite a number about in this district at present. Several others I have shot at and missed, mostly at dusk or after dark; and twice I have had kittens brought in from the jungle about three weeks old, at the end of January and beginning of February.

BADLIPAR, P. O.,
ASSAM, E. P. GEE.
July 11, 1937.

III.—THE ALLEGED WILD DOG OF MT. POPA, BURMA.

Early in 1936 in a paper on the Asiatic Wild Dogs (*Proc. Zool. Soc.*, 1936, p. 33), I incidentally remarked that 'curiously enough next to nothing is known of the character of the Dholes of Burma, where the collectors for the Mammal Survey . . . failed to secure a single specimen'. This statement, based on the absence of specimens in the British Museum, produced a letter from Mr. Shortridge to Mr. Millard saying that he secured one on Mt. Popa and asking what had become of it. True enough the specimen was entered by Wroughton as *Cuon rutilans,* with the collector's number attached, in the MS. list of the collection from Mt. Popa, and cited under that name with Shortridge's note about it, in Wroughton's report (*J.B.N.H.S.*, vol. xxiii, p. 471, 1915). In this note the animal was described as an adult ♀, with only 10 mammae and weighing 19 lbs., which was run down and killed by a village dog, a fate which Shortridge surmised would never befall its larger ally, the typical Wild Dog of India.

I was particularly anxious to see this specimen, not only on account of the small number of mammae which in the Wild Dog vary from 6 to 8 pairs, but also to secure the flesh measurements of what was evidently from its weight an unusually small Wild Dog, which might prove to be a distinguishable form restricted to Mt. Popa, a volcano rising from a dry area unsuitable as a habitat for the ordinary Wild Dog. But the specimen could nowhere be found either in the British or Bombay Museums. But the mystery of its disappearance is now solved. The skull, with the locality and number attached, turned up in the British Museum. It is the skull of an old, small domestic dog, with a short muzzle and high crown, measuring only just over 6 inches in length, about as long as a Jackal's, much shorter than the skull of the Wild Dog and quite unlike it in all the characters which distinguish the skulls of *Cuon* and *Canis*. It had been put aside, unregistered, as of no zoological interest. Possibly Oldfield Thomas detected the error in its identification after the issue of Wroughton's report, but neither he nor Wroughton published the correction of it that was called for. In doing this I should like to add that Shortridge and Wroughton are by no means the first zoologists who have failed to distinguish 'dingo-like', feral dogs (*Canis*) from the oriental Wild Dog (*Cuon*).

ZOOLOGICAL DEPARTMENT,
BRITISH MUSEUM.

R. I. POCOCK.

IV.—CURIOUS BEHAVIOUR OF BISON (*BIBOS GAURUS* H. SM.).

It was the month of May in the Kanara Forests of the Bombay Presidency.

I had started at dawn to try and procure a good bull bison. Soon after arrival in the forest my 'shikari' and myself came on a shootable head which I shot at 5.40 a.m.

I continued my walk in order to get to know the country and look for other spoor such as tiger, panther, bison, or elephant. Several bison tracks had been seen and the fresh pug marks of a tiger. I decided to return home at about 7.30 a.m., and was walking down the track, on which the tiger pug marks were, towards the main motor road about half a mile away, when I heard a barking-deer bark in a frightened way. Shortly afterwards I heard a tiger roar exactly in the same way he does when turned by a stop in a beat—it sounded deeper although it was some distance away from me. Thinking that he may have been disturbed off a kill I pushed through some thick Bamboo forest to have a look and see. On arriving at a teak and bamboo plantation from where the noise seemed to have come I turned up a little incline along a ride at the edge of the plantation. I had not gone 30 yards when coming down the incline at right angles to me I saw a tiger moving at a fast walk. When twenty yards away he stopped and I bowled him over. Within a few seconds a tigress appeared over the brow of the hill and came down at an amble stopping exactly where the tiger had stopped and looked at her mate making a noise like a cat mewing. She dropped to my second shot. I had to go up and give the tiger another shot as he was still kicking but could not move. The sounds of the third shot had scarcely died away when I heard a noise in the plantation and shortly afterwards a young bull bison walked out on to the ride quite near the tigress and started sniffing the carcase. Being afraid that he might damage the skin with his horns and hooves I shook a young teak sapling to frighten him away. He looked up, took not the slightest notice and went on sniffing. A little later another bison came and joined the first and only moved off when the 'shikari' and myself clapped and shouted at them—even then they only walked very slowly into the thick forest. I was unable to find any signs of a fight between the tiger and bison or of the tigers having killed. The two bisons snorted at me again when I was having a search for evidence of this strange occurrence. I would like to know if anybody can explain the reason of the bisons' attitude. Usually they are very shy animals—the breaking of a twig or a whiff of human scent send them charging away—but on this occasion after three shots from a 450 H.V. rifle a bison walks out and smells the carcase of a dead tiger. It sounds incredible.

Mr. Hiley the Chief Conservator of Forests, Bombay Presidency, informs me that he has never heard of or seen the like before in all his service in India.

The bison were so close that I could see they had not been mauled or attacked by the tigers and no kill was found.

Government House,
Bombay, C. G. TOOGOOD.
May 31, 1937.

V.—ABNORMAL ELEPHANT TUSKS (*ELEPHAS MAXIMUS*).

(*With a plate*).

I send you two photographs of a solitary elephant carrying tusks of a most unusual shape and symmetry. The awkward position in which he wore his tusks is really responsible for his death. This elephant had been doing extensive damage to crops in the Borelli River area, in the Tezpur district of Assam. I was able to follow up that night's tracks and after about 6 miles came upon him, wallowing in a small *bheel* 200 yards ahead of where I stood. As I was deliberating the best method of approaching him, he winded us and made off full tilt. I had a very good Miri tracker with me, and after pushing on his trail for an hour or so I thought it was going to be an all-day job, when the tusker foolishly changed his direction and plunged into 'Geruka' jungle. We listened carefully and could then hear him breaking through about a quarter of a mile ahead. We left his tracks and ran as fast as was possible in soft mud along the edge of the Geruka patch to head him off, and we arrived at the other end just as the tusker was emerging into the tree jungle at the spot we were standing. He came out directly facing us, and one barrel from my .470 fetched his brain. Had this elephant kept to tree jungle he would probably have put many miles between us before pulling up.

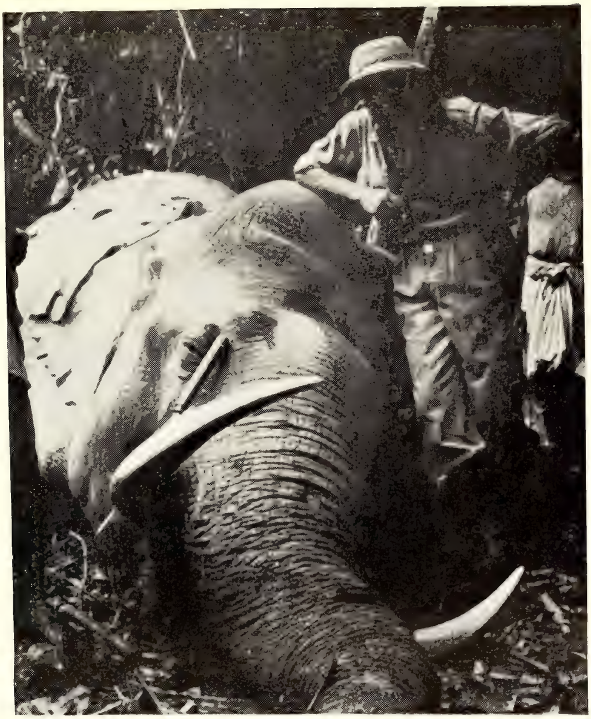
I shall be interested to hear if any other of your readers has seen an Indian elephant with tusks similarly pointing to the heavens.

THE KACHARI GAON TEA CO., LTD.,
TEZPUR, ASSAM.
G. D. L. MILLAR.
August 14, 1937.

VI.—ABNORMAL HORN GROWTH IN THE MUNTJAC (*MUNTIACUS VAGINALIS*).

(*With a photo*).

I enclose a photograph of a Kakur head with two coronets on one pedicle. The lower part of the horn is smooth and nearly black



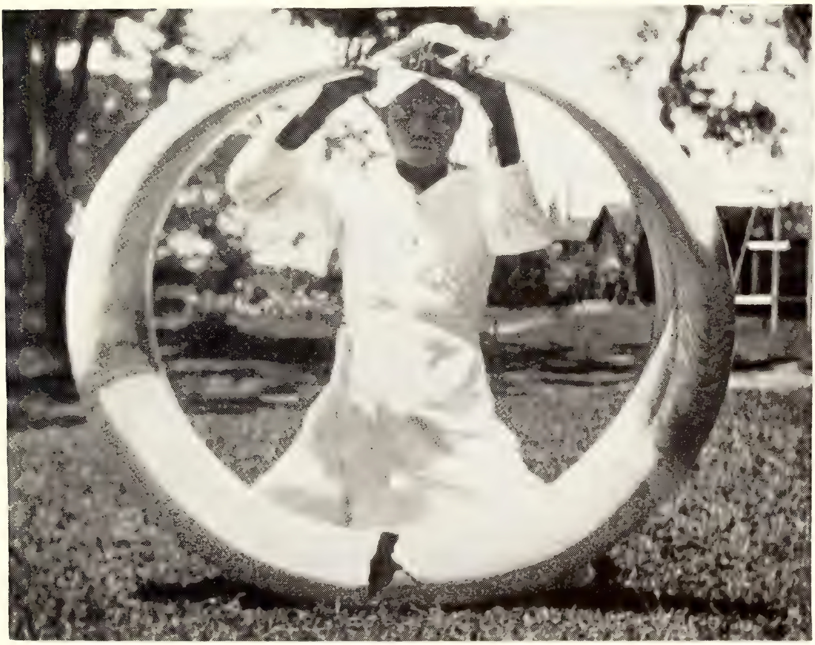
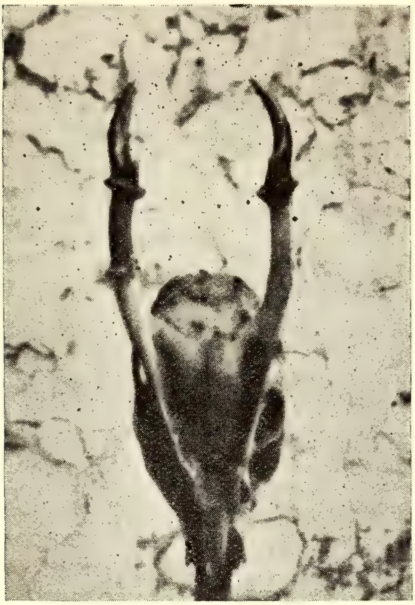


Photo by *G. D. L. Millar.*

Abnormal Elephant Tusks.



Abnormal horn of the Muntjac (*Muntiacus vaginalis*).

with no covering of skin and as such distinct from the pedicle. The animal had a very dark hide.

DHALIPUR P. O., HERBERTPUR,
DISTRICT DEHRA-DUN, U.P., F. H. PEPPE.
May 21, 1937.

VII.—THE USE OF FIREWORK OR ROCKET CARTRIDGES IN THE PROTECTION OF CROPS.

I have recently experimented with excellent results on the use of 12-bore firework or rocket cartridges, in bolting elephants out of ryots' crops; the most suitable cartridge being the type bursting with a brilliant flash and loud report at the end of flight. The elephants stampede out in panic, and are chary of returning to the same field that night. The cartridges are at present expensive, about Rs. 17 per 100, German made; with an increased demand the makers should be able to produce them at half the price and of the kind required, instead of an assortment of types in packets as now sold. I venture to think that this may go a long way to solving the vexed problem of the issue of gun licenses for crop-protection, the majority of which now cover weapons used chiefly for poaching. If the license prohibited the holder from purchasing cartridges other than firework or rocket dealers would not be able to supply anything else. The effect on crop-raiding animals other than elephants would I am sure be the same. The gun is aimed directly at, or a little above, the crop-raider, according to distance.

HONNAMETTI ESTATE,
ATTIKAN P.O.,
December 3, 1936.

R. C. MORRIS.

VIII.—SOME NOTES ON THE FAUNA OF MALAYA.

In my article 'Early Days in Malaya' (*J.B.N.H.S.*, xxxviii, 241) I mentioned that certain beasts and birds of India did not exist in that country, and among these are the hyæna, the jackal, the vulture, the common kite, and the grey-necked crow. For the greater part the fauna of the two countries is the same, but it is noticed that in some there is a slight difference in colouring, and that in others the habits are not alike. Environment is responsible for this, and while a darker or a lighter shade in colour is due to habitat, the greater shyness noticeable may be accounted for by the fact that it is only in recent years that certain denizens of the forest have become acquainted with Man.

A few notes bearing on this might be of interest, and at the same time I take the opportunity to record a few incidents omitted previously, and to make observation as to the seeming paucity of wild life in those jungles, which impression is only corrected by a visit to one of the museums. The several museums in Malaya contain stuffed specimens of a great variety of birds which I have never seen in their wild state. I lived in the jungles for many years, and it was not that I was ignorant about the birds being there, or that I did not look for them. It just happened that they would not be seen. We know that peafowl and the Argus pheasant are there, and in some districts I was in they were all around me. I heard them, and looked for them, but never saw one. It is not difficult to understand, that, in forests carrying heavy undergrowth, walking up ground birds is next to impossible, and as any attempt to do so is noticed by them the chances of their coming back to oblige is very remote.

It is possible that certain of the wild life which I have stated does not exist there, is known and reported on by naturalists, and if this is the case it gives proof to my contention that these birds and beasts are more shy of man than they are here.

Common birds like shrikes, the weaver birds, the orioles, wagtails, the woodpeckers, the kingfishers, the green barbets, hoopoes, nightjars, and various pigeons and doves are in some instances Malayan forms of those occurring in India, but the jungle cock is not the jungle cock of the Nilgiris, the robin is not the same, and the buzzard appears to live differently. Mynas in Malaya are essentially jungle birds and are never seen near human habitations. Among the wild beasts, the tiger has a liking for dogs, and this I believe is not the case in India, and I give instances of the carnivorous tendencies of the common wild pig of the country. I include a few birds which perhaps do not call for comparison, but notes on which may be of interest.

PEA-FOWL AND ARGUS PHEASANT.

The wild pea-fowl of South India is a shy bird, but it comes out to feed on crops, and can be seen in the jungle. I doubt if any sportsman in Malaya has ever shot one, and I have not met any one who has even seen one. One does not hear of them doing damage to crops, or that they ever come near villages, and old Malays will tell you that they can only be obtained by traps. Like the pea-fowl the Argus pheasant is very seldom seen, and I know of none having been shot. I lived for two years at a place called Kendong on the borders of Malacca, where, judging by the calls I heard in all directions every morning, they must have been fairly numerous, and yet I never set eyes on one. I endeavoured on many occasions with much patient stalking to try and bag one, but without success. I sometimes got so near that the piercing call 'pee-ow' was most deafening, but the moment I bobbed up the bird disappeared. It was on one of these occasions that I saw a black panther tracking the same bird, and it speaks well for my stalking that I saw the beast before he saw me, but for a second only, and in that second both he and the pheasant were gone. I have heard tell of the cock bird's courtship dance and the circle on the ground he prepares for this, but it has not been my good fortune ever to see one of these grounds. I imagine the only means of getting a pheasant would be to sit up all night in a tree and wait for the performance next morning, but it would have to be a seat in a forked branch, as I am sure the erecting of a machan would drive the bird away into the next county.

SAMBHAR.

The Malayan sambhar is very destructive to young rubber trees, and before proper methods of fencing were adopted many thousands of pounds worth of damage was done by this beast. Strange to say he seemed to have no liking for seedlings, or for plants up to two and three years old, and since for this period no fencing was found to be necessary, planters were lulled into a sense of security from loss by damage from animals, and it was quite suddenly that many estates woke up to the fact that the sambhar had discovered that the bark of four- and five-year old trees was just what he wanted. Rubber planting was undertaken on a large scale from about the year 1906, and at the end of 1910, when rubber was selling at twelve shillings the pound, anything from five to ten millions of trees had reached the age as food for deer. Damage was done on practically all the estates I knew in Negri Sembilan and Johore, and also in Malacca, and at a low estimate I would put the number of trees destroyed, in the first few years following on 1910, at 50,000; and the value of a tree at that time was £2.

Planters and Directors of Rubber Companies who might chance on these notes would possibly think this a much exaggerated statement, but thirty years is a long stretch and memories are short lived, and I would ask them to refer back to old reports, where they might read that in a certain field twenty or thirty trees were wiped out in a night, or that during the month a hundred trees were lost. These figures when spread over a period of years, and occurring on not one but several estates, might easily mount up to considerably more than the figure of fifty thousand which I give, and which is only one per cent of five million trees. Many thousands of pounds were spent on fences, and once again a lesson was taught. Barbed wire fences erected to a height of five feet appeared to be satisfactory for a few weeks or perhaps a few months. The deer were suspicious of the fence but they soon found out that they could jump it. Fences bordered the jungle and there was no space for a running jump and this meant they could leap over from a standing position. Higher fences were required and the remedy was to interlace the wire with saplings to a height of eight to ten feet, and this meant more expense. It was noticed that when the tapping of trees was commenced no new damage was done. It was not that the bark had become harder and grown unsuited to the deer's taste, since un-tapped trees in the same field were still subject to attack. The reason for this seems unexplainable.

I have never attempted to shoot a stag on the Nilgiris, but for the fun of the game I have stalked and got within range on a number of occasions. If driving is done, shooting is still more easy, as on these hills the stag breaks cover to cross open country, and as the woods are small a close shot can be had. Conditions are very diffierent in Malaya, and a sportsman who bags a sambhar is a man who accomplishes something really difficult. Stalking is impossible, and driving has to be done, but before a drive is organized a tracker is sent in advance to locate the stag and then to return and report. He knows to within fifty yards or so where the stag is lying up, and by no means can you expect it to break in country affording a clear view. The shooting has to be done in the jungle, and a shot at a running stag under these conditions is not easy. A clever shikari will drive him to the most open space available, but this might only mean that it is not so dense as the area from which he breaks, and you may be sure when he does reach this spot he bounds off faster than ever and makes the proposition an exceedingly difficult one for the man behind the gun. It is not always that the stag is seen, and my experience is that he is very seldom seen. One animal bagged over a series of a dozen shoots is a fair average.

I should like to put in a word here about the Malay as a tracker. I am told there are no better trackers than the jungle people of India, and while not wishing to make any comparison, I must say this for the Malay that he is clever at the game, is reliable and keen, and possesses the useful trait of truthfulness, and in this last respect can give points to the average professional shikari of the Nilgiris.

On the Nilgiris I have more than once been asked to believe that the marks made in the sand by a man who had run ahead were the pug marks of a panther which had only just moved off, and once I was shewn a cow which had died a natural death, and which after death had been scratched about with a knife, and was told that a panther had done this. A Malay would never make himself out to be so great a fool, and he would be ashamed to tell such lies.

WILD CATS AND CIVETS.

There is a large variety of cats in the Malayan jungles, two of which I have seen on the Nilgiris, viz. a large jungle cat and a smaller spotted cat. On these hills I have also seen a small species of civet. In Malaya we have this small civet, and a very large one which measures four feet and over from nose to tail.[1] I did not take accurate measurements of one that I shot, but I estimated its length at fully fifty inches, and its weight at twenty-five pounds. It was in tall grass, and when I fired I thought I had brought down a panther. There are two cats which are uncommon there, and which perhaps might not be generally known in this country. Description must necessarily be difficult to one who has not taken up the study of Natural History, and I hope my endeavour at doing so will enable naturalists to identify them. The first to mention is an animal as big as the jungle cat, but of different colour and markings, with a long tail and not the stumpy tail of the other. Its colour can be best described as dark mahogany, and it has a black tip to its tail. It is one of the most handsome cats I have seen, and having seen and secured only one, I regret the skin is not with me now. It was in my bungalow for many years, and as it may possibly be still there I have written about it. The other cat is yellow, or of a bright gold colour.[2] It is long in the body and has a long tail, but is considerably smaller than the big civet mentioned. I saw a pair walk across a stream over a fallen tree, and with the sun shining on them they looked extremely pretty. It will be interesting to know if these two cats are found in India. I must recount here an incident which, although it might sound like a Fairy Tale, is given exactly as it happened. My dog 'Bob' had killed quite a number of small civets which came after the fruit we had growing round about the house. I used to let him out early in the mornings, and very often he caught and killed one of these animals which was late in getting back to the jungle. One morning he did not rush out as he usually did, and in fact would not move out of the house. He did not appear to be sick, but no enticement on my part would induce him to come beyond the doorway, where he stood and sniffed the air in a nervous way. I thought he must have sensed a tiger so I took him inside to wait till the day grew brighter. An hour or so after this my car-driver, who knew about Bob's skill as a killer, casually mentioned that it was unfortunate the dog had not been let out at his usual early hour as he might have killed several civets that day. He went on to say that he had seen about forty of them moving about in a body till sunrise. The man was very definite about this, and although, after much questioning he reduced the number from forty to twenty, I felt there was no doubt but that the civets were there in force and that Bob knew this and was afraid of their numbers, or even had the idea that they were there to do him in. There is the possibility that there was a tiger about as well and that the civets were hanging about till it had gone.

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[1] The civets referred to are probably the Malay form of the Small Indian Civet (*V. indica klossi*) while the larger civet is probably the Burmese Civet (*M. megaspila*).—EDS.

[2] This may have been a small specimen of the Golden Cat (*P. temmincki*). —EDS.

I am reminded of something amusing that happened far up a river called the Palong. A naval officer friend was in camp with me, and in one of the villages on the river we saw two cats of a bright pink colour. Stewart, my camp mate, wanted to buy them and in his best Malay offered a fairly big price, but the honest old people whom he spoke to, laughed and told him that the cats were white ones, and that they had been dyed.

MACACS.

There is a monkey in Malaya which Malays call 'Broh', and which looks like a small edition of the South African baboon. In its jungle haunts it is a fearsome beast and sometimes attacks men, but when caught young is easily tamed and is made use of to gather coconuts.

There is usually one 'Broh' in each village which has been taught to climb the coconut palm and drop the nuts which his keeper makes him to distinguish by jerking his leading rope in a peculiar way.

About twenty-five years ago one of these animals, a large male, took up his quarters in a small area of reserved forest which was practically in the heart of the town of Kuala Lumpur. He was a danger to people, and bit several before he was rounded up and killed.

WILD PIG.

Like the rest of his kind, the wild pig of Malaya is a glutton. It is known that he eats carrion, and in the pioneer days in Perak, before the Authorities had had time to lay down Burial Laws, or perhaps before they had the means to enforce such laws, certain nationalities, careless in this respect, dug shallow graves from which pigs had no trouble to exhume the dead bodies. Cases were being constantly reported by construction engineers. As a carnivorous animal he is not so well known, but when I mentioned the following incident to a District Officer, a Mr. Fleming, he told me he had on two or three occasions seen a wild boar attack and eat sheep and goats. The incident I record is rather different, and is astonishing from the point of view that the happening was so sudden and so unexpected on the part of the victims. I met a Mr. Rae out for a walk with his two terriers, and presently ahead of us we spied a herd of pig. The dogs saw them at the same time and immediately gave chase. Warning Mr. Rae that his dogs would be hurt unless they were called off, I followed him as he ran ahead to do this. We were in a railway cutting, and by the time we had got round a curve the pig had made their get away into the jungle and there was no sign of the dogs. There were also no sounds to be heard, and we were at a loss to know where to search, but while discussing our next move I happened to pick up a dog's collar, and in another minute or two we discovered one other, both of which were recognized as belonging to the two dogs. The collars were found in the open but there were no bones about, and the presumption is that the dogs were surrounded and completely devoured. I hope, if Mr. Rae should happen to come across this note, he will kindly write to confirm the incident.

COONOOR, S. INDIA,
October 2, 1935. H. E. BURGESS.

IX.—SOME INTERESTING RECORDS OF BIRDS IN THE PUNJAB.

During the past three years my *Shikari* and I between us have secured specimens of the following birds in the South-East of the Punjab. These have been examined by Mr. Hugh Whistler, who has kindly furnished me with the particulars of previous records given below:—

1. **Metopidius indicus** (Lath.). Bronze-winged Jacana.

A juvenile ♂ obtained at Karnal on 5th September, 1934. There appears to be no previous Punjab record.

2. **Emberiza aureola** (Pall.). Yellow-breasted Bunting.

♀ shot at Jagadri in the Ambala District on 5th March, 1935. An adult ♂ was obtained in the same locailty by A. E. Jones on 22nd February, 1920 (*J.B.N.H.S.*, xxxi, 1003).

3. **Eurystomus orientalis** (L.). Broad-billed Roller.

♂ shot in the *sal* forest at Kalesar in the Ambala District on 19th May, 1935. No previous Punjab record has been traced.

4. **Alcemerops athertoni** (Jard. & Selby). Blue-bearded Bee-eater.

♀ obtained from a small flock in the Kalesar forest on 23rd February, 1936. Stewart (*Zoologist*, 1886) records one shot at Koteghar on October 20th,

5. **Chrysocolaptes guttacristatus sultaneus** (Hodgs.). Hodgson's Golden-backed Woodpecker.

♀ obtained on 24th and ♂ on 26th February, 1936 in the Kalesar forest. This appears to be the first record for the Punjab.

6. **Pericrocotus speciosus speciosus** (Lath.). Indian Scarlet Minivet.

A pair obtained from a mixed flock of this and *P. brevirostris* in the Kalesar forest on 3rd December, 1936. 'I have only once procured a pair north of Bilaspur; it does not seem to be found in the interior of the hills' (Stoliczka, *J.A.S.B.*, 1868). A ♀ was obtained at Garampani and ♂ ♀ at Pulga in the Kulu Sub-division of the Kangra District in May (*Mission Babault*, p. 158).

7. **Hydrocissa malabarica malabarica** Gmelin. Large Indian Pied Hornbill.

♀ shot in the Kalesar forest on 2nd December, 1936. 'In my father's game-book there is a note about "black and white Hornbills" found at Morni on 28th November, 1886. This can only refer to this species, which occurs in Dr. Scott's list under the locality Siwaliks' (Whistler, *J.B.N.H.S.*, xxvi, 176).

RAWALPINDI,
PUNJAB,
July 15, 1937.

H. W. WAITE, M.B.O.U.
Indian Police.

X.—MIGRATORY MOVEMENTS OF THREE WELL KNOWN BIRDS IN THE TANJORE AND SOUTH ARCOT DISTRICTS.

The three birds under reference are 'The Indian Paradise Flycatcher', 'The Rosy Pastor' and 'The Indian Oriole'.

Two of these birds are local migrants, while the Rosy Pastor is a true migrant in the Tanjore and South Arcot Districts.

Observations have been recorded in the case of the Paradise Flycatcher during four years and in the case of the other two birds for three years, the results showing that the Paradise Flycatcher is found during the period October to April, being absent for approximately five months in the year. The Rosy Pastor is found during the same period, but as the two departure dates are 13-4-35 and 19-2-36 it may be assumed that they stayed longer than usual in 1935 or left earlier than usual in 1936.

The Indian Oriole is also found during the period October to April, the date 22-5-36 is unusually late and is the last date on which a female was seen in the South Arcot District. All other orioles had left before this date in the Tanjore District.

For easy reference a table of actual departure and arrival dates for the above birds is furnished. The dates represent when the first and last bird of each species was seen by me.

TABLE OF DEPARTURE AND ARRIVAL DATES.

Species.	1933		1934		1935		1936	
	Departure	Arrival	Departure	Arrival	Departure	Arrival	Departure	Arrival
The Indian Paradise Flycatcher. *Tchitrea paradisi paradisi* ...	......	3-10-33	14- 4-34	14-10-34	25-3-35	3-11-35	23- 4-36	18- 9-36
The Rosy Pastor. *Pastor roseus*	......	......	......	3-10-34	13-4-35	13-11-35	19- 2-36	2-12-36
The Indian Oriole. *Oriolus oriolus kundoo*	......	......	......	29-10-34	23-4-35	4-11-35	22- 5 36	6-10-36

TANJORE,
February 9, 1937.

C. H. BIDDULPH.

XI.—CURIOUS BEHAVIOUR OF THE JUNGLE CROW (*CORVUS MACRORHYNCHUS*) AND THE WHITE-BACKED VULTURE (*GYPS BENGALENSIS*).

On the 30th May (1937) I came upon the remnants of a White-backed Vulture's (*G. bengalensis*) nest with a fully fledged young one in it. During the absence of the parent the young bird perched on neighbouring branches, made short flights and then returned to its perch near the nest. As soon as the parent bird arrived the young would flop into its nest, or rather what was left of it, and behave like a true nestling, flapping its wings and making all possible noises and movements in pleading to be fed. The adult bird always alighted near the nest. Its arrival was the signal for a pair of enterprising Jungle Crows immediately to be in attendance, to snatch the crumbs that fell, as I then thought. But the crows behaved quite differently—theirs was not the role of Lazarus. As soon as the adult vulture regurgitated some food for her young the crows would either sit on the young vulture's back or fly to its mouth and try to snatch a morsel. The old bird attempted from time to time to drive the crows away but they moved out of reach to return again the next instant.

When the adult vulture departed the crows left the nest and the young bird again took up its perch on its favourite branch; but on the return of the parent the same manœuvres were repeated.

BOMBAY NATURAL HISTORY SOCIETY,

May 31, 1937.

BOMBAY. C. McCANN.

XII.—THE DISTRIBUTION OF THE WHITE-EARED BULBUL [*MOLPASTES LEUCOGENYS LEUCOTIS* (GOULD)] IN THE SWAMPS NEAR THE VAITARNA RIVER.

Messrs. Sālim Ali and Humayun Abdulali in their paper on 'The Birds of Bombay and Salsette' (*J.B.N.H.S.*, xxxix, p. 101) with reference to the status of the White-eared Bulbul (*Molpastes leucogenys leucotis*) suggest that the occurrence of this bird, within the area dealt with in their paper, is perhaps due to escaped birds breeding within the area, or to an immigration from further north. If anything, the second suggestion appears to be more likely. On the 20th March this year (1937) while walking along the swamps between Virar and the Vaitarna River, I observed the bird to be fairly plentiful. It 'associated' with *M. cafer cafer* and *Otocompsa f. fusciaudata* and roosted in the swamps. The bird appeared to be definitely established in the locality. Later, I have observed the bird in the swamps at Ghorbunder, Salsette Island.

There seems to be little doubt, as the authors suggest, that this bird appears to be associated with the distribution of *Salvadora persica*.

Bombay Natural History Society,
Bombay. C. McCANN.
May 27, 1937.

XIII.—THE SOUTHERN INDIAN ROLLER OR BLUE JAY [*CORACIAS BENGHALENSIS INDICA* (LINN.)] KILLING A SMALL SNAKE.

Baker and Inglis in *The Birds of Southern India* refer to the Roller killing and eating mice and small reptiles and in the *Journal* of the Society, No. xxxix, p. 179 there is an interesting note regarding this bird killing and eating a large scorpion.

While out on the 3rd December this year I noticed a Roller suddenly fly up from an aloe hedge with a small live snake 8 or 9 inches in length in its beak. The snake was held just behind the head and was twisting about trying to get a grip on some portion of the bird. The Roller was uttering its harsh cry all the while and although the snake's struggles almost caused it to release its hold it eventually made for a palmyrah palm where it is presumed it killed the snake.

I have seen a Crow-Pheasant sitting on a rail along the railway track engaged in killing a large black scorpion and it is presumed it was going to eat it as I did not see the whole operation due to the bird becoming alarmed and flying away with the scorpion in its beak.

Tanjore,
February 9, 1937. C. H. BIDDULPH.

XIV. BREEDING OF THE LITTLE INDIAN NIGHTJAR (*CAPRIMULGUS ASIATICUS ASIATICUS*) IN THE CHINGLEPUT DISTRICT.

(*With a plate*).

I see in the report of the 'Vernay Ornithological Survey of the Eastern Ghats' (vol. xxxviii, No. 1, August 1935, p. 39) that 'nothing has been recorded about the breeding season' of the Little Indian Nightjar, *Caprimulgus asiaticus asiaticus* in the Presidency of Madras. It may therefore be of interest to record that on July 11th, 1937, my husband and I disturbed a nightjar in an exposed spot in the scrub jungle near the foot of the Tambaram Hills (100-200 ft.), and, after some search, discovered a single egg, on the ground among the stones and rocks. It was brownish-pink much mottled with darker red, and somewhat lighter than the surrounding stones. We were not able to return to this place until August 1st; we then found that the egg had disappeared from the spot where we had seen it on July 11th, but after careful search we found the nightjar some yards lower down the hillside, crouched low with its chin on the rump of the chick. Not even when we bent over them to examine them did either move; in going up the hill to the place where we had previously seen the egg, we must almost have trodden on them, but not the slightest movement had attracted our attention.

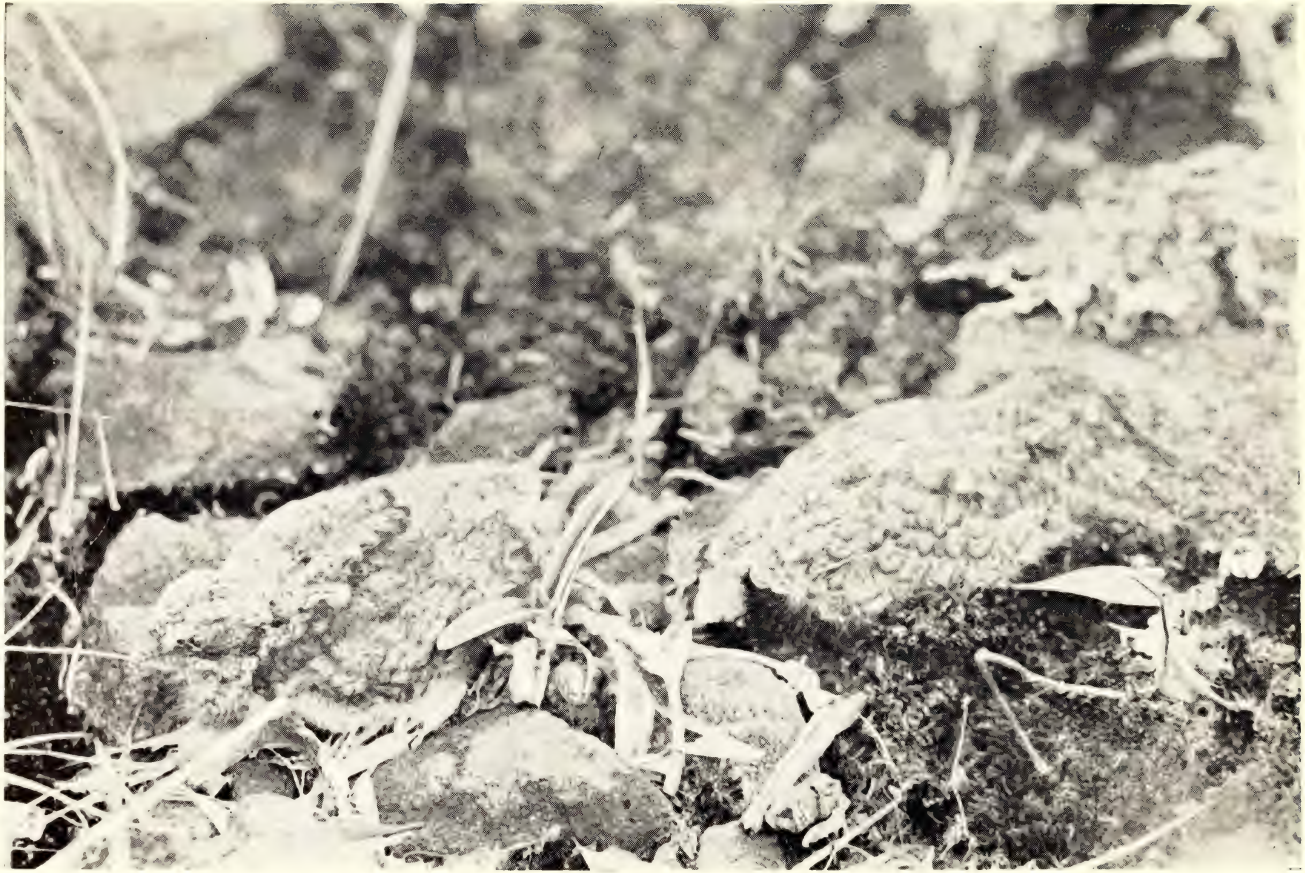
On August 5th we went again, hoping to photograph the two, but they had again moved, and while we were searching among the stones, from somewhere close behind us the nightjar flew up and past us, followed immediately by the young one; they took shelter among the rocks and thorny bushes of the hillside, where we could not find them.

We believe this nightjar to be *Caprimulgus asiaticus asiaticus;* the bird with the 'tuk tuk tuk tukeroo' call is abundant in the scrub jungle of this district (16 miles S.W. of Madras City) as in our garden, and has been seen and heard by us in every month of the year, during the five years in which we have been resident here; and as we not infrequently flush nightjars under the bushes in the day time, we have been able to compare them with the descriptions in *Birds of Southern India* by Baker and Inglis, and in Whistler, and there seems little doubt that these birds are *C. a. asiaticus.*

The moving of the nesting position has also been observed by us in what we believe to be *C. indicus indicus.* On April 28th 1935, we discovered a nightjar and two eggs among the rocks and stones on a hillside on the Ootacamund Downs (about 8,000 ft.); when revisiting the place a few days later, we found that the eggs had been moved several feet, and on May 11th, we found the young birds in still another spot. An interesting feature was the difference in the behaviour of the parent bird before and after the hatching of the young. Each time when disturbed by us when sitting on the eggs, the bird flew straight up and swiftly away to a considerable distance; but after the chicks were hatched it flew slowly along the ground, flapping and dragging a wing as though wounded, and settled at only a short distance from its young.

We found a nightjar and two young on the Bikkepatti Ridge (about 6,500 ft.) on the N.W. edge of the Nilgiris on May 5th 1932; this we also believe to be *C. i. indicus.* In this case also, the parent bird tried to distract our attention by much flapping along the ground. The two chicks kept their eyes tightly shut, and were so motionless and matched the stony ground so completely, that in our search for them we were actually looking at them for some time without realising their presence.

I enclose a photograph we took of the Ootacamund nightjar chicks. It will be seen in the photograph that the feathers where the chick is in contact with the ground when squatting are fluffy.



Chicks of the Common Indian Nightjar (*Caprimulgus asiaticus*).

Photo by: *Author*

This makes the outline of the bird obscure, and is no doubt an important factor in the camouflage.

MADRAS CHRISTIAN COLLEGE,
TAMBARAM,
CHINGLEPUT DISTRICT,
September 4, 1937.

ALICE D. BARNES.

XV.—ON THE BREEDING OF THE OYSTERCATCHER (*HAEMATOPUS OSTRALEGUS* SUBSP.) AND OTHER BIRDS IN THE BENGAL SUNDERBUNDS.

It seems high time that the rather terse statement in the second edition of the *Fauna* (vol. vi, 167) in regard to the Oystercatcher was amplified. Writing of the Chinese race (*Haematopus ostralegus osculans*) Mr. Baker says: 'An Oystercatcher, probably of this race, has been obtained with its eggs, breeding on an island in the Sunderbunds, but the skin has not been available for comparison.' This is repeated, almost word for word, by the same author in the *Waders and Semi-Sporting Birds of India*. The actual facts may perhaps now be placed on record.

In the Easter Holidays of April 1922, I had the good fortune to be the guest of Mr. L. R. Fawcus, I.C.S., then Collector of Khulna in Bengal. We spent then about 100 miles south of Khulna on the sea-shore, an area in which owing to the almost complete absence of fresh water, Man is, or was then, conspicuous by his absence, and which was a paradise for birds of all kinds, spotted deer, pig, etc. On April 21st we saw a pair of Oystercatchers on a long narrow strip with scattered stones along it. The next day (April 22nd) they were in the same place and we had little difficulty in watching the hen bird on to her nest which contained fresh eggs. These eggs we took and they were later given by Mr. Fawcus to Mr. Stuart Baker. The birds nested again near the same place and on a subsequent visit Mr. Fawcus saw the young ones. In the cold weather of 1933-34, he again saw a pair there but, as he only had a rifle, was unable to secure a specimen.

On the Easter Sunday, we rather foolishly tried to plod out across the mud of the bay to an island some three or four miles out at sea, over which we could see a great cloud of Terns hovering. This trip might well have ended disastrously, as, for the greater part of the journey, the mud was over our knees, and it was impossible to take more than six laborious steps at a time. Eventually after some hours we managed to struggle back to land and later just managed to reach the island at high-tide in a row-boat. We found it covered with a very large breeding colony of Gull-billed Terns (*Gelochelidon nilotica*) whose eggs—many quite fresh—were all over the island. They were remarkably tame and shewed little fear of our party. There were also two colonies, each of 30-40 pairs of the Large Crested Tern (*Thalasseus bergii* subsp.). Unlike those of the Gull-billed Tern, these nests were almost touching each other, bare hollows in the sand each containing one egg. The close-packed snowy mass of sitting birds was a most beautiful sight, and well worth the difficulty we had had in reaching them. Equally remarkable was the varied colouring of the eggs. I took one series of 18 eggs from adjoining nests, each different from the next and ranging in colour from heather-purple to almost pure white, but an accident unfortunately destroyed a number of these before they reached the South Kensington Museum in 1923.

On the same island, we found a nest of *Esacus recurvirostris,* the Great Stone Plover, with one of the eggs just chipping. This bird went back on to her eggs while I sat within fifteen yards of her, being doubtless anxious to shield the eggs from the fierce midday sun. She sat there on them panting with her mandibles open.

When on leave in 1923, I met Mr. F. C. R. Jourdain and Mr. Stuart Baker at the South Kensington Museum and told them the above facts. The eggs of the Oystercatcher and some other eggs were eventually given by Mr. Fawcus to Mr. Baker, with full data as to their origin. It was not however possible to obtain skins to decide the geographical races of the birds mentioned.

Since this trip, which I owe to Mr. Fawcus' kindness, I have kept a close lookout for the Oystercatcher in Burma without success. It is not likely to occur in 'North Burma' (*Fauna*) where there is no sea-coast but may well occur from Arakan South and East to the Tenasserim coast. Mr. S. F. Hopwood tells me he saw Oystercatchers near China Bakir (Hanthawaddy) about 1927 (*J.B.N.H.S.*, xxxvii, 4 April 1935) and Mr. C. E. Milner shot one on the Bassein coast in 1914.

It is improbable that they breed, except very locally, on the Burma coast. I have searched several areas for them in vain.

WINCHESTER,
May 3, 1937.

J. K. STANFORD,
Indian Civil Service.

XVI—EARLY AND LATE SNIPE.

I find from my game book from entries of 30 years that the earliest I have shot snipe in India is 1st September at Loralai and also on the same day of the month at Peshawar. I have seen snipe in Baluchistan, but not shot any, on 20th August. In Southern India, Hyderabad, I have generally got my first snipe early in October and once, this year, the 20th September. Other guns got snipe early in September this year at Hyderabad.

In Northern India and Baluchistan I have shot snipe up till the end of March with an occasional bird in April and a good bag at Parachinar in the Kurram Valley in April.

In Hyderabad I have shot snipe every year as late as the first week of April and this year got 3½ couple of full snipe at Bijapur in Bastar State on 18th April. Last year in South Chanda, C.P., not far from Bijapur I saw several snipes on 17th April.

All the April snipes I have shot and seen in Hyderabad and Chanda have been in wooded cover near permanent springs or in the soakage behind the embankments of big tanks. These snipes are very dark in colour, sluggish in flight and inclined to lie very close especially in undergrowth. When flushed they utter a cry quite different from the ordinary 'scrape' of a snipe.

The number seem very late and this year also the early snipe gives the impression that they are family units and that the birds remain in India all the summer, possibly breeding here. It would be very easy to get someone to observe the tank at Bijapur, because the snipe there are well known to the local people and are found along and below the embankment between the two halves of the village.

H.Q. 4TH (SEC'BAD) CAVALRY BRIGADE, — G. de La P. BERESFORD, M.C.
Brigadier.

BOLARUM.
April 26, 1937.

XVII.—THE BREEDING OF THE LITTLE GREEN BITTERN (*BUTORIDES STRIATUS JAVANICUS*) IN SALSETTE ISLAND.

On the 30th May (1937) I found a nest containing three young of the Little Green Heron Bittern (*Butorides striatus javanicus*) at Ghorbunder. The nest, a rude construction of loosely-put-together twigs, was situated in the thin branches of a mango tree some thirty feet from the ground. The tree was some distance from the water's edge of the creek.

The three young showed a remarkable range in size, but this was particularly true of the smallest, which was almost half the size of the other two—probably a weakling. On approaching the nest the 'youngest' bird remained sitting in the nest while the other two walked out of it on to the thinnest branch for safety and were captured with some difficulty. Besides being able to walk with ease along the thin branches, I noticed that they used with good effect their necks as 'hook' to aid them in climbing. The neck would be hooked over a branch and the legs then brought up and with a little flapping they would lift themselves on the new perch.

The young were partially in down but the quills of the feathers were in evidence all over. The down is a dark smoky grey all over except round the belly where it is almost white.

The parent bird (male) returned shortly after being disturbed and was secured. On examining the gullet, which seemed swollen, it was found to contain 2 specimens of *Belone strongylura* V. Hass, 8½ and 6½ inches long respectively and the head of a Syagnaid.

This bird is a local resident, but as far as I am aware the nest has not been recorded from the area.

BOMBAY NATURAL HISTORY SOCIETY,
BOMBAY, C. McCANN.
May 31, 1937.

XVIII.—OCCURRENCE OF THE BITTERN (*BOTAURUS S. STELLARIS*) IN SOUTH MYSORE.

While shooting round the edge of a tank near Nanjangud, about 12 miles south of Mysore City, on 12 December 1936, I flushed a Bittern from the reeds and shot it.

As this bird is stated in *F.B.I.*, 2nd edition to range only so far as Bangalore, its occurrence nearly 100 miles still further south may be worth recording.

Identification was kindly confirmed by Mr. Hugh Whistler to whom a wing was sent.

KALHATTI E. G. PHYTHIAN-ADAMS.
NILGIRIS, *Major I.A.* (*Retired*).
April 24, 1937.

XIX.—SEXUAL DIMORPHISM IN THE STAR-SHELLED TORTOISE (*TESTUDO ELEGANS*).

Apart from the characteristic concavity observed in the males of most Chelonians, and the frequent disparity in size often observed between the sexes, little seems to have been recorded regarding the sexual characters. Recently the Society received two pairs of the Star-shelled Tortoise (*Testudo elegans*) from H .H. The Maharaja of Bhavnagar. A careful examination of the specimens showed clearly marked sexual differences.

Carapace: In the females the colouring of the shell is much brighter and more pronounced, the humping of the dorsal shields (in particular) is much more pronounced, and the posterior and anterior marginal shields are far more serrated and the points more acute.

Legs: The forelegs in the females carry large and more conical scales (almost free in the upper $\frac{2}{3}$) and the hind feet are armed with much longer claws, probably a provision for excavating the egg chamber at the time of deposition.

Tail: In females the tail is reduced to a mere short conical stump whereas in the males it is much more elongated and if straightened will protrude almost a couple of inches beyond the shell. Normally, however, the tail is carried adpressed to the shell, curled up behind either of the hind legs.

The above details apply to adult specimens.

Bombay Natural History Society,
Bombay, C. McCANN.
August 4, 1937.

XX.—OCCURRENCE OF *PSAMMOPHIS CONDANARUS* ? IN BERAR.

A snake found at Chikalda (Berar) at about 3,500 ft. in the Melghat hills by E. Berchten in June 1937 seems to come nearest to the above. It agrees with the descriptions of this species by Wall (*How to Identify the Snakes of India*, 1923) and Boulenger (*F.B.I.*, Reptilia & Batrachia, 1890) except on the following points:—It disagrees with Wall in having 15 instead of 17 rows at 2 head-lengths behind head and only 1st (not 1st and second) supralabials touching the nasal. The localities given by Wall are 'Cutch, Punjab, Sind, Ganges basin and Burma'.

It disagrees with Boulenger mainly in colour (rather markedly) and in the distribution which he gives as 'This species has hitherto only been recorded from the Punjab, Cutch, the North-West Provinces, Simla, Bengal, the Kurnool district, and Pegu'.

The following is a general description of the specimen sent. Length 10 in. Costals 15; 17; 13; Ventrals 173; Sub-caudals 74; Anal divided; one rather long loreal. Scaling of the tree-snake type without apical pits or ventral keel.

Colour: The head is pale olive brown above with a darker line from the snout, passing through the eye and fading on the nape; the upper and lower lips, chin and throat are pure shining white, each infralabial and some of the adjacent scales of the throat having a rusty speck (marking a pit?) in the centre of each. The upper parts of the body are pale olive brown above fading a little on the flanks. There is a dark brown median stripe edged sharply with black formed as follows:—The vertebral row and one row on either side of it dark brown, the next row on either side has each scale dark brown on its inner edge, black in the middle and pale olive, like the rest of the upper surface, on its outer edge. The belly is yellow each ventral having a rusty line near each end. These lines are shorter in front but become almost continuous from about mid-body onwards. The iris is pale yellow and the pupil round.

Forest Office,
Nagpur, C.P., E. O. SHEBBEARE.
June 19, 1937.

[The specimen referred to above was submitted to Dr. Malcolm Smith for verification and we give below his reply.

'Many thanks for the interesting snake. I identify it provisionally as *Psammophis condanarus,* which is more variable in colour than is usually supposed.'—Eds.].

XXI.—SEXUAL DIMORPHISM IN THE SEASNAKE [*DISTIRA CYANOCINCTA* (DAUD.)].

On the 3rd May this year, Mr. J. B. Greaves, sent the Society a pair of live *Distira cyanocincta* which he had found in copulation at Mervi-malad, near Bombay. While examining the specimens I noticed that they exhibited certain differences which may be recorded as possible sexual characters.

(*a*) The colour banding of the body in the male was markedly stronger, and the rings were more complete than in the female.

(*b*) The low jaw in the male was very distinctly coloured burnt sienna fading out a little beyond the base of the head. The colouration was not present in the female.

(*c*) In the female the head was much more elongate than in the male.

(*d*) The tail in the male was markedly thicker than in the female.

(*e*) In the male the scales of the body and particularly those on the head, were strongly keeled, much more so than in the female. The scales of the female were much smoother and more shiny, particularly the head scales.

Later, on consulting Col. Wall's *A Popular Treatise on the Common Indian Snakes* (*J.B.N.H.S.*, xxvi, p. 436) I have found the following remark :—'The very distinctive keels and their serrations are much more conspicuous in males where they are sometimes most pronounced and even spinous on the belly. In females and young though somewhat obscure they are usually discernible if looked for.'

With regard to the time of the year when this species breeds in India, Col. Wall has no information owing to the specimens he examined having no date. However, for Siam he records a gravid female, from the Chantabum river, as having been captured in March (1916). This specimen contained embryos 10--10½ inches long. In the present instance the female measured 3 ft. 9 in. long and contained approximately 30 eggs of various sizes, the largest of which measured 1 × ¼ in.

Bombay Natural History Society,
Bombay. C. McCANN.
May 20, 1937.

XXII.—BREEDING SEASON OF THE JEW'S NOSED SEASNAKE [*ENHYDRINA VALAKADYEN* (BOIE)] IN BOMBAY WATERS.

On the 15th March this year (1937) a large female of the Jew's Nosed Seasnake (*Enhydrina valakadyen*) was caught in the fishermen's net at Mora, Uran Island. On dissection the specimen was found to contain eleven eggs, with embryos measuring approximately 42.5 mm.

Col. Wall in his paper *A Popular Treatise on the Common Indian Snakes* (*J.B.N.H.S.*, xxvi, 805) states that the breeding period varies from 12th November till February in Cannanore, and that young measuring 12½-17 inches were obtained from Madras in June. The Bombay specimens would thus breed a little later than those in South India.

Bombay Natural History Society,
Bombay. C. McCANN.
May 27, 1937.

XXIII.—FREAK SEEDLING OF THE GRAPE FRUIT.

(*With a photo*).

Seedling of Grape Fruit in Flower.

A Grape Fruit seedling two months old, in flower. This is considered very uncommon with this particular variety of Citrus plants as they are not known to flower before the seventh year.

No. 11 Colvin Road,
Allahabad. Mrs. MARGARET RATH.

XXIV.—SOME OBSERVATIONS ON BOTANICAL NOMENCLATURE.

Alteration in the botanical names by which plants are known is so frequent a cause of complaint, especially by applied botanists, that is to say horticulturists, agriculturists, foresters, etc., that some explanation for the reasons underlying such changes seems desirable.

In the early days of plant classification the names used were vague and often consisted of several words giving a brief description of the plant. For instance: the common Elder was termed *Sambucus caule arboreo ramoso floribus umbellatis* by Royen in 1740. At that period too, and for many years after, there was comparatively little communication between botanists and but little literature and small opportunity for comparing plants handled by the several workers. Everyone had to depend almost entirely on the published descriptions. As few species were then known it was considered that brief indication of the general relationship and one or two individual characters sufficed, with the result that the descriptions were usually meagre and have proved often very inadequate for the determination of the plant without seeing the very specimen from which the description was made. Given these premises it will readily be apprehended that quite frequently the same species was separately named and described by different workers under different names, and, on the other hand, different workers identified entirely different plants with some other named and described by another scientist. An example of these sources of error will be found in the genus *Terminalia*. Linnaeus described one species under the name of *Terminalia Catappa*; at a somewhat later date Lamark described the same species as *T. moluccana;* later still Roxburgh, believing that he had the same species as Lamark's, identified with it one of the varieties of *T. belerica;* finally Wallich inscribed the same name on a sheet of his Herbarium Catalogue. Thus we have three separate species to which the name *T. moluccana* has been applied.

The first great step towards an orderly nomenclature was taken by the Swede Carl von Linné, who, in 1753, propounded the binomial system under which every species of plant bears two names only: the first is that of the genus to which it belongs and therefore indicates its general affinity, and the second is its individual or specific epithet. This was an obvious advantage in every direction, especially in brevity for now the common Elder becomes *Sambucus nigra* of Linnaeus.

Nevertheless, this system in itself does not dispel the confusion occasioned by the factors explained above, a confusion that assumed such alarming proportions that it was found necessary to discuss the situation at the International Botanical Congress held in Paris in 1867. A set of rules drawn up by Alphonse de Candolle was adopted under the title: 'Lois de la nomenclature de botanique.' Experience showed, however, that these rules were not 'fool-proof' but lent themselves to diverse interpretations in part. Consequently, at the second International Congress at Vienna in 1905 they were further discussed and certain modifications were accepted and incorporated in the International Rules of Nomenclature. Additions and modifications have been effected at subsequent meetings of the Congress, including the last that took place at Amsterdam in 1935. The resolutions carried on this last occasion are still being investigated and formulated by the appropriate committees and their publication may be expected by the end of 1936 or soon after.

The following are some of the more important points in the rules as they now stand:

1. The name of any species must consist of a combination of a generic name followed by a specific epithet. They may be followed by the name of a further subdivision, e.g. a varietal name.

2. The same name cannot be applied to distinct genera, nor the same epithet to two distinct species in the same genus.

3. No name is accepted unless it is *effectively published*: that is to say, that it has been made known generally to botanists by publication in some accessible work and is accompanied by a description of the group or by detailed figures. Therefore, mere names unaccompanied by a description or only in manuscript or not generally accessible to botanists, are not valid.

4. When choice has to be made between two validly published names applied to the same plant, the rule of priority comes into play and the earlier published name must be accepted, subject to the exceptions noted later.

5. Priority is based on the year of publication of Linnaeus's fundamental work *Species Plantarum* in 1753. Names published earlier than that need not be taken into account.

6. A validly published name, even though illegitimate under the rules, is not available for a different plant. Thus: *Picea Abies* is the correct name under the rules for the common Spruce. *Abies Picea* was the combination applied to the same species by Miller in 1768; but for this fact this last combination would be the correct name for the silver fir for which it cannot be used under the rules as it is preoccupied, and the silver fir must bear the name *Abies alba* Mill.

7. Recognising that changes in generic names are to be avoided as far as possible, especially where well-known names are concerned, it was decided to establish a list of 'nomina conservanda' which preserves certain generic names as against obscure though more correct ones if priority were strictly adhered to, e.g. the genus *Ailanthus* of Desfontaines (1789) is conserved in preference to *Pongelion* of Adanson (1763). This rule does not apply to specific names, which cannot be conserved.

8. The name of the author of a generic name or a specific combination should be written (often abbreviated) after the name. When a species is transferred from one genus to another the specific epithet is retained and the name of the original author should appear in brackets followed by that of the transferer,

Thus, the first name given to the common Spruce by Linnaeus was *Pinus Abies.* Subsequently the plant was transferred to the genus *Picea* by Karsten and became *Picea Abies* (Linn.) Karst.

This citation of the author is essentially an abbreviated reference to the place of publication and also indicates approximately the date of publication. Further, it is very necessary in cases where more than one species has been given one and the same name as with *Terminalia moluccana* mentioned earlier.

The above epitome is, of course, far from exhaustive; a full discussion would take far too much space. I would refer anyone anxious for a fuller account to an excellent résumé by Miss M. L. Green which appeared in vol. 10, No. 1 of the *Empire Forestry Journal* in 1931. Indeed, I have had this publication under constant reference while compiling this note and have, in places, copied the wording and used the illustrations.

We may now consider the main reasons which make a change of name imperative.

1. If the same name is given to two different species the one described and validly published at the earlier date retains the name and the other must have a new name. This has occurred in the case of genera as well as of species. An example of the former lies in *Bassia.* In 1766 Allioni bestowed that name on an Australian genus of the *Chenopodiaceae.* Koenig suggested the same name for a genus of the family *Sapotaceae* and this was accepted and published by the younger Linnaeus in 1771. As two genera cannot bear the same name and Allioni was the first to publish it, *Bassia* must remain the name for the genus in the *Chenopodiaceae* and the later genus must take the next available name given to it which is *Madhuca,* by which name the Indian trees previously grouped under the name *Bassia* must now be known.

2. When a species has been misidentified with a validly described species and is discovered to be something different, it must receive another name. I have already cited as an instance the case of *Terminalia moluccana.*

3. When a genus is subdivided into two or more genera, one of the divisions will retain the original name and the others will be provided with fresh generic names. As a case in point I may cite the large genus *Eugenia* from which the genera *Syzygium, Jambosa* and *Meteoromyrtus* have been segregated. The original specific epithets must be retained in the new genera unless the combination has already been used, as was indicated in the case of *Abies Picea.*

4. When the true identity of an effectively published plant, which was uncertain for one reason or another, is established and it is found to be identical with another plant described at a later date, the first published name must stand. Thus, *Cyperus imbricatus* of Retzius being insufficiently described was considered to be unidentifiable and was omitted from the *Flora of British India.* The original specimen on which Retzius founded this species came to light and it was then found to be identical with the sedge described at a much later date by Vahl under the name *C. radiatus,*

This latter binomial must relapse into synonymy and Retzius's name stands as the correct name for the species.

Those engaged on the economic application of botanical knowledge have represented that they have neither the time nor the facilities for keeping abreast with nomenclatural research and often are unable to ascertain the correct name that should be applied to some important species owing to the changes enforced by the rules. This difficulty was admitted at the Congress at Amsterdam in 1935. Accordingly, it was resolved to draw up a list of the important economic and ornamental plants named in accordance with the International Rules, which list shall remain in force for the usage of such applied botanists for a period of ten years. A special committee was appointed to consider all the species for which claim for inclusion has been put forward and it is hoped that the list will be ready for publication before long.

KEW.

C. E. C. FISCHER.

XXV.—THE FLOWERING OF *STROBILANTHES*.

I am afraid this note is somewhat belated and contains very imperfect information, but I have just been re-reading Mrs. Robinson's article published in vol. xxxviii, No. 1 of 15-8-35 and think it may contain some scraps of information which may be of interest.

At least four species of *Strobilanthes* flowered profusely in every sholah on these hills between the months of August 1936 and April 1937, in fact almost every *Strobilanthes* plant growing under our heavy evergreen forest seems to have flowered and died during this period. The sholahs on our grass hills, where the undergrowth was almost entirely *Strobilanthes,* now present an extraordinary appearance in being bare of undergrowth where a short time ago they were dense. The bison who browse freely on *Strobilanthes* leaves must find their feeding somewhat restricted. In the dry months of the year from December to March the bison often do not visit the dry grass for quite long periods but stay inside any sholah which is large and thick enough, browsing on *Strobilanthes* and other shrubs.

I am afraid I do not know enough about the genus to identify each species positively, but you may be able to identify some of them from the following descriptions. I would emphasise that every plant I have seen flowering in this period has been growing either in, or on the edge, of evergreen forest. The big flowering of *S. Kunthianus* which I reported in 1934 all took place on the open grass land and I saw none of it flowering in the open this year; in fact the seedlings from this flowering are only just beginning to show up in any quantity.

The following are the distinct forms I noted in this present flowering.

(1) A dense growing shrub with small thin bright green smooth leaves, growing up to 8 ft. high on fairly thin stems which tend to bend over under the weight of leaves and flowers. The flowers are carried on the stems in bunches and at first glance the clusters of buds look exactly like large ears of oats or Brome Grass. The buds and flowers are sticky to the touch although the leaves are smooth. The flower is small. It is often white and occasionally tinged with a delicate blue.

The plant is very common on the edges of all the jungle belts here, 3,600 ft. and is equally common at 6,000 ft. It thrives in any place where the jungle is thin and it can get a bit light, but does not do well where the jungle is thick. It was the first to appear in flower and the last to finish. I can remember having seen this in flower before shortly after I came here in 1924, but have no record of the date although I think it was probably 1925-6.

(2) A big sturdy shrub which grows thickly to about 7-8 ft. in our swamps and anywhere on the edges of jungle where there is moisture, such as round the edges of rock outcrops.

The stems are sturdy and thick; the leaves are big and broad, very prettily tinged with dark red underneath, and are rough and hairy. The florescence is a compact dark brown cone about 3 to 4 inches long very like a polished fir cone to look at and about the same thickness. Each flower in the cone opens individually and barely shows up as a very dark blue with orange red stamens. The flower stem is so short that when open each flower only just protrudes from the cone and except for the orange colour of the stamens might not be noticed at all.

Like the first I have seen this flowering before and at the same time about 1925-6.

(3) A plant very similar in general appearance to the last with broad hairy dark green leaves but no under tinge or red. This grows well under heavy shade as well as on lighter patches and the stems are often thick enough to use for walking sticks. The flower is a mauvy blue. It is common in sholah at all elevations but particularly so in the stunted jungle at the open grass level 6-8,000 ft. I have not seen it flowering before, and as far as I can remember since 1925, the sholahs on the grass hills where it has now flowered and died have always had a plentiful supply of this undergrowth.

(4) A plant with much smaller dark green rough leaves and of a much denser shrubby appearance growing up to about 5-8 ft. high. The flower is a delicate mauvy blue. This also prefers the lighter edges of jungle and rock out-crops. I think this is probably *Kunthianus,* the increased growth of the bush being due to its growing under shelter and not in the open. I have not seen this flowering before.

I am sorry that this note is not more exact and that I did not collect specimens, but it is probably worth while recording for the future reference of anyone in 1947-8. It is of interest that the S.W. monsoon of 1935 was very much more open and sunny than usual, and very much below normal rainfall; in fact it might almost be said to have failed us. Possibly this had something to do with the determining of the flowering season. A mass of small seedlings germinated in May this year wherever there had been a flowering. Our first rain showers arrived at the end of March and there were fairly continuous showers through April.

INJIPARA ESTATE,
VALPARAI P.O.,
June 7, 1937.

J. H. L. WILLIAMS.

BOMBAY NATURAL HISTORY SOCIETY.

A meeting of members of the Bombay Natural History Society and their friends was held at the Prince of Wales Museum on Wednesday the 25th August 1937 at 6.30 p.m., the Hon'ble Justice K. W. Barlee, Kt. presiding.

The Honorary Secretary, Mr. H. M. McGusty, announced the election of the following twenty-five members since the beginning of the year:—

Mr. A. J. Yandle, Moran P.O., Assam; Mrs. Phyllis M. Spreadbury, Burma; The Secretary, Cachar Club, Ltd. Silchar; Mr. B. Basu, Khar, Bombay; Mr. L. D. Scott, Kuweit, Persian Gulf; Mr. J. D. Sherston Baker, Bombay; Mr. C. A. Emerson, Colaba, Bombay; The President, Malda Game Association, Malda, C.P.; Brother Godfrey, I.S.C., St. Placid's School, Chittagong; Mr. J. N. A. James, Bombay; Mr. C. E. Fischer, R.E., Fategarh, U.P.; Dr. F. B. Khambatta, M.B., B.S., M.R.C.S., L.R.C.P., D.P.H., D.T.M. & H., Bandikui; Capt. K. S. McGregor, Jubbulpore; His Majesty S.M. Bao-Dai, Emperor of Annam, Hue, French Indo-China; Mr. Lionel J. Dee, Coimbatore; M. K. S. Fatehsinhji, Bhuj, Kutch; Mr. C. Gore, Assam; Mr. E. R. Sherman-James, Assam; Mr. M. C. C. Turner, Bombay; The Principal, Queen Mary's High School, Bombay; The Principal, St. Berchman's College, Changanacherry, Travancore; Mr. Gordon Williams, Gangapur; Mr. H. R. D. Robey, Assam; Capt. R. S. Vine, R.A.M.C., Wellington, Nilgiris; and Mr. H. R. Lindsay, Punalur, S.I.

Mr. Sālim Ali, a former Assistant Curator of the Society, then read a paper on an Ornithological trip to Afghanistan during the early part of this year.

His account of the expedition was made all the more interesting by the display of a number of well-chosen lantern slides.

An Ornithological Trip to Afghanistan.

The Expedition was financed and led by the celebrated British Ornithologist Col. R. Meinertzhagen, D.S.O. Its objects were to collect birds, plants and other Natural History specimens and to study ecological conditions in the field. Col. Meinertzhagen is one of the world's foremost authorities on *Mallophaga,* a group of external parasites of birds, and the collection of these was his own special department.

The country north of Kabul was visited up to the Oxus river which forms the northern boundary between Afghanistan and Russia. The method of transport in Afghanistan is chiefly by motor lorries. The roads are passable, but likely to become slushy and dangerous in the rainy season. Travelling and camping out is perfectly safe in modern Afghanistan. Punishments for crime are drastic, and theft is practically unknown. The expedition spent two months camping in the open. The motor lorry was left by the roadside unattended, with baggage and ammunition on board, and not a single article was lost.

The bird life belongs chiefly to the Palæarctic Zone, but there is also a sprinkling of Ethiopian and Indo-Malayan forms.

The bird collection includes many interesting forms, some which are likely to prove new to science.

The collections and data are being co-ordinated and worked out by Col. Meinertzhagen in England. The full report, it is hoped, will be published by the end of the year.

Some of the Expedition's most valuable experiences in Afghanistan were with migrating birds returning in Spring to their breeding grounds in Central Asia and Siberia. Many birds that winter in India and Africa migrate over Afghanistan. This fact had been long surmised but not established until the expedition was able to confirm it.

Mass movements of a large number of species was observed. In particularly large numbers were the Rosy Pastors—familiar winter visitors to India. These birds are some of Man's staunchest allies in his fight against the destructive locusts. They breed in Central Asia and their breeding grounds usually coincide with those of the locust. The young Pastors are fed from the time they are born up to when they leave their breeding grounds almost exclusively on locusts in the various stages of the insect's growth. Although largely netted, killed and eaten in India, the Afghans protect the Pastors zealously on account of their usefulness.

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BY

The late Rev. E. BLATTER, S.J., Ph.D., F.L.S.

and

W. S. MILLARD

With 31 Coloured and 37 Black and White Illustrations

Extract from Introduction

THIS book consists of the description in popular language of some of the Beautiful Indian Trees, of which 31 coloured and 37 black and white illustrations are given.

It has been prompted by the many inquiries which are constantly being made as to the correct names of the trees so conspicuous when in flower, and it is hoped that it will prove of assistance to those who take an interest in these beautiful trees and wish to know not only their correct names, but also something about their history.

These trees are not all indigenous as the majority have been introduced into India.

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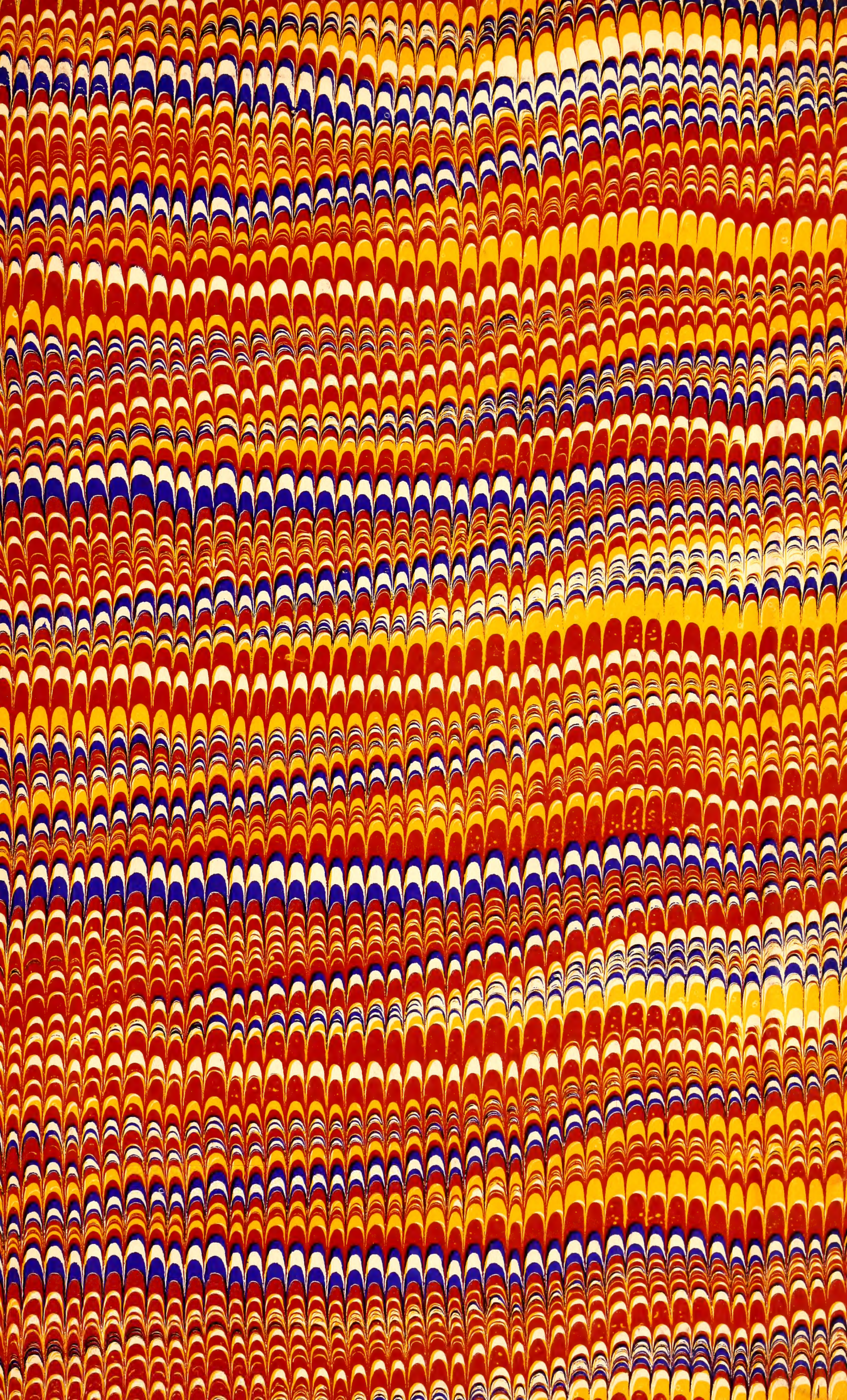

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